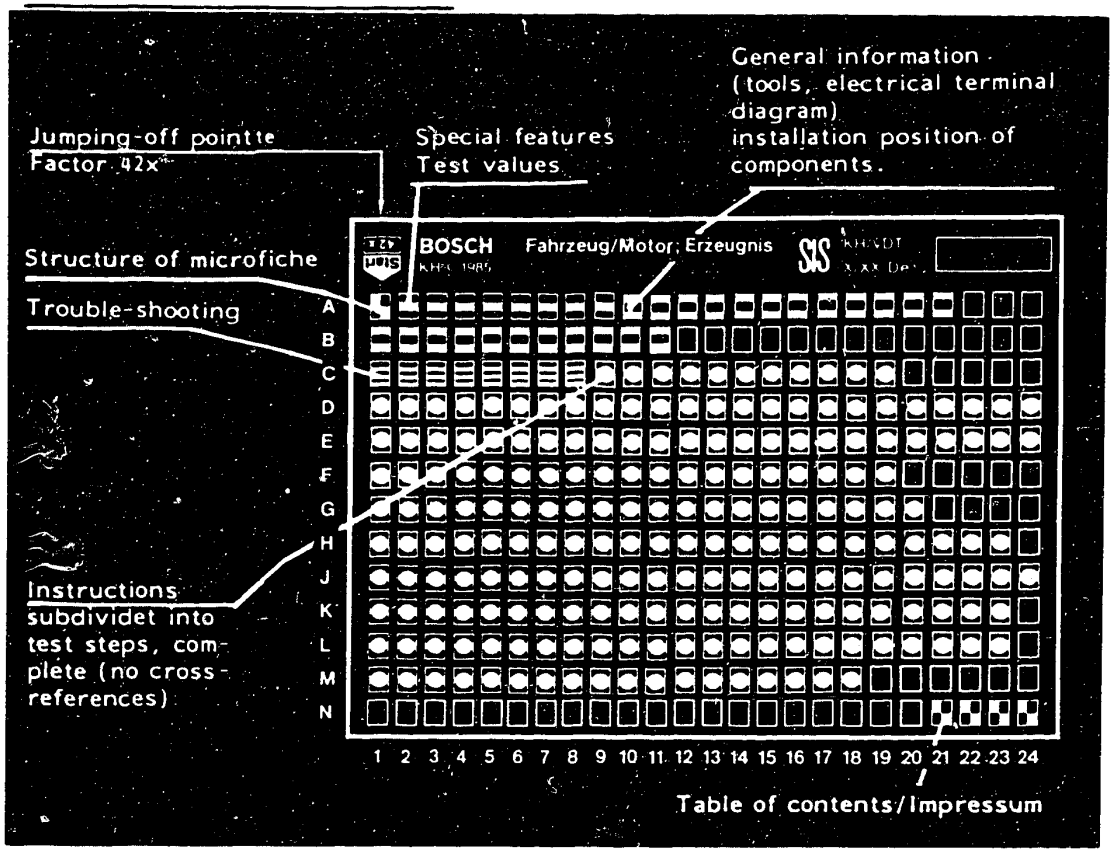
Structure of microfiche



1. Read from left to right
2. Title of microfiche (appears on each coordinate)

E16	Product/component/test step Vehicle/engine

Coordinate

3. Limits of section

Beginning Mid-section End One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

1. SPECIAL FEATURES

- Exhaust-gas recirculation (1980 model year - pneumatic exhaust-gas recirculation) (1981/82/83 model year - pneumatic exhaust-gas recirculation) (1984 model year - electric/ pneumatic exhaust-gas recirculation)
- Exhaust turbo-supercharger
- Soot burn-off filter

2. TEST SPECIFICATIONS

D8

2.1 Idle speed

650 ... 850 min^{-1}

E13

2.2 Nozzle-opening pressure

135 + 8 bar

E3

2.3 Preheating times

°C	Preheating time (sec.) approx.
0	6
+20	4
+40	2

G1

2.4 Compression loss

Max. 25 %

J1

2.5 Injection timing

Static with and without start-of-delivery sensor system (FBG)
Setting value: 24° BTDC
Checking value: 24 ± 1° BTDC

Dynamic with start-of-delivery sensor system (FBG)
Setting value: 15° ATDC at 750 ± 50 min^{-1}
Checking value: 15 ± 1° ATDC at 750 ± 50 min^{-1}

2.6 Check charge-air pressure

J9

Test specification: 0.7 ... 0.8 bar

2.7 Check vacuum system

E7

Test specification: 400 mbar vacuum

2.8 Check delivery pressure

E19

Measuring point between fuel pump and main fuel filter.

Delivery pressure at idle: 0.6 ... 0.8 bar
at 3000 min^{-1} min. 0.8 bar

2.8.1 Check final delivery pressure

E24

Measuring point between fuel pump and main fuel filter.

Final delivery pressure at idle: min. 1.1 bar
at 3000 min^{-1}: min. 1.3 bar

2.9 Check vacuum control

E6

Measuring point at EGR valve

at 700 ... 2600 min^{-1}:	280 ... 360 m bar
as of approx. 2400 min^{-1}:	slowly falling
at 3000 min^{-1}:	approx. 60 m bar

2.10 Check engine-speed sensor

M7

at 700 ... 800 min^{-1}: min. 4 V

Increasing voltage with increasing engine speed

M9

2.11 Check control-rod-travel sensor

Test specifications:

Pins 1-2: 23 ... 27 Ω

2-3: 23 ... 27 Ω

1-3: 44 ... 56 Ω

M11

2.12 Check pressure transducer

min^{-1}	mbar	mA
at 700...2600	280...360	≙ 530
as of approx. 2400	slowly falling	≙ 370
at approx. 3000	approx. 60	0

M13

2.13 Check change-over valve

min^{-1}	mbar	Volt
at 700...800	0	0
at 1000...2500	approx. 60	approx. 12
at min. 3000	0	0

M15

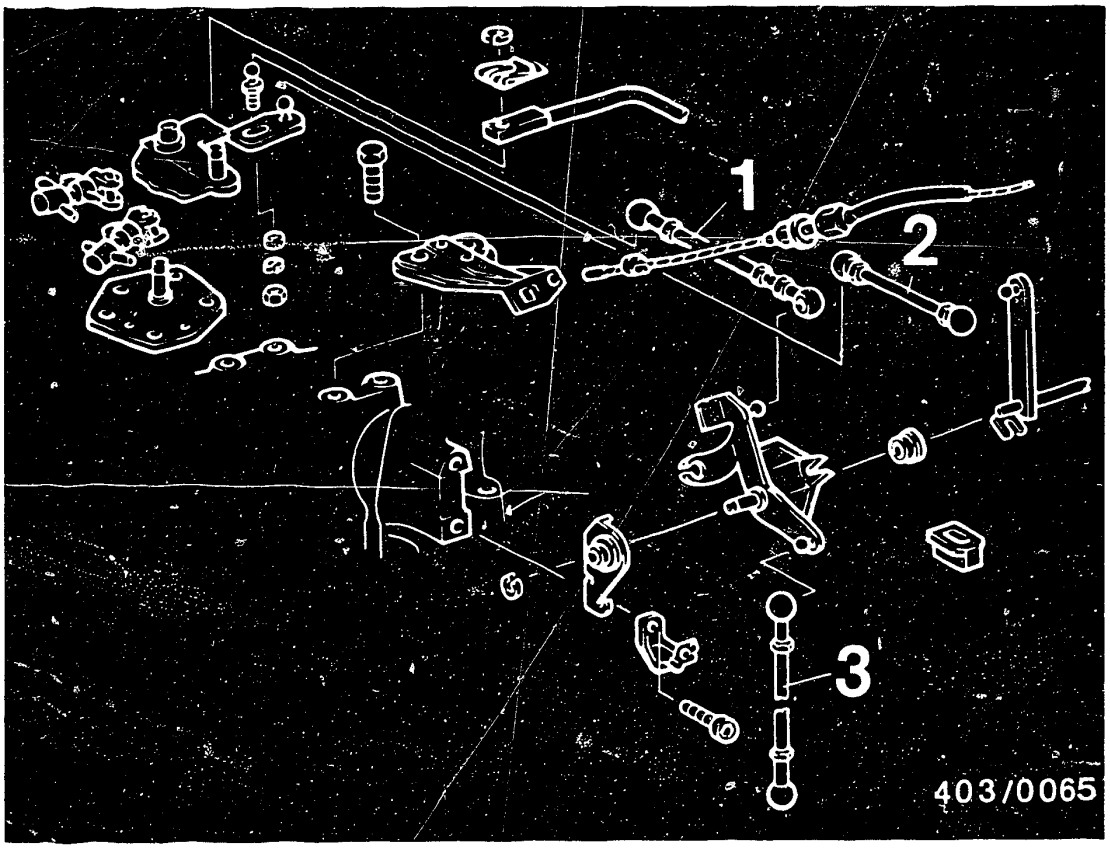
2.14 Check soot burn-off filter

Exhaust backpressure:

at 4000 min^{-1}: 0.8...1.3 bar

2.15 Tightening torques

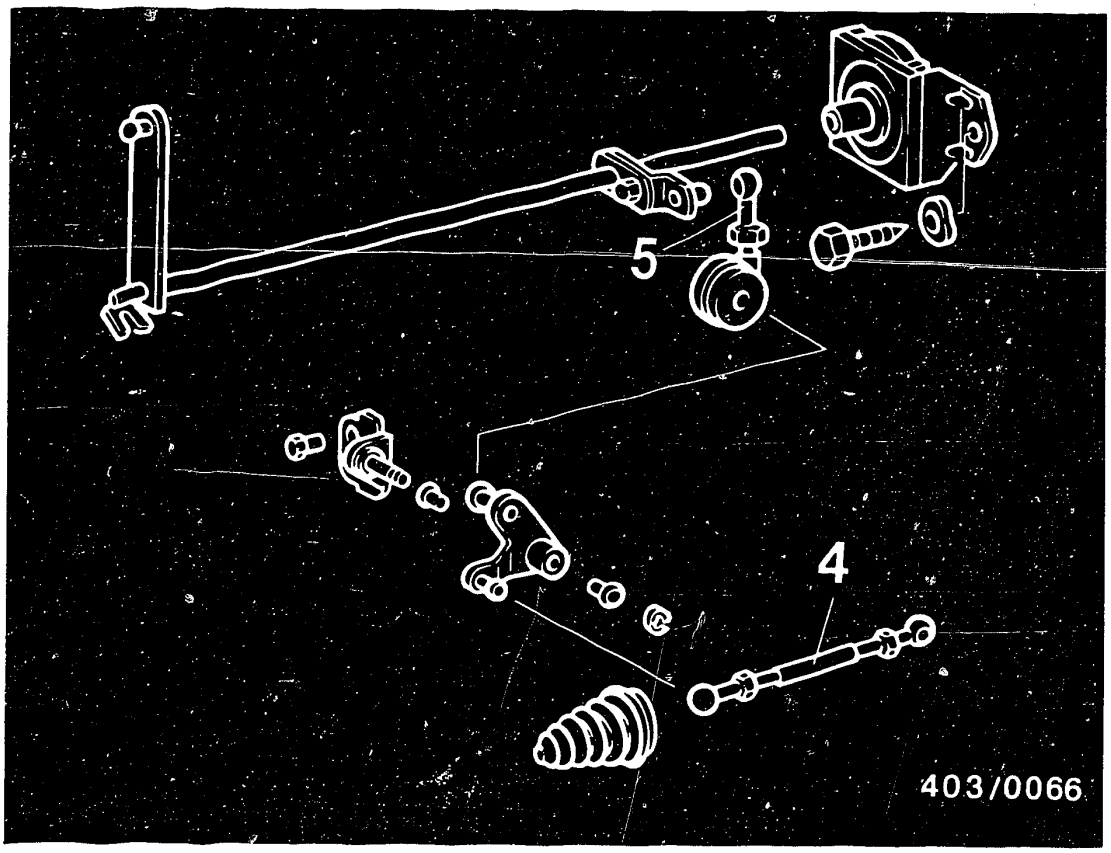
Camshaft gear fastening screw	80 Nm
Nozzle-holder assemblies	70...80 Nm
Nuts for oil filter cover	20...25 Nm
Delivery-valve holders	40...50 Nm
Injection lines	25 Nm



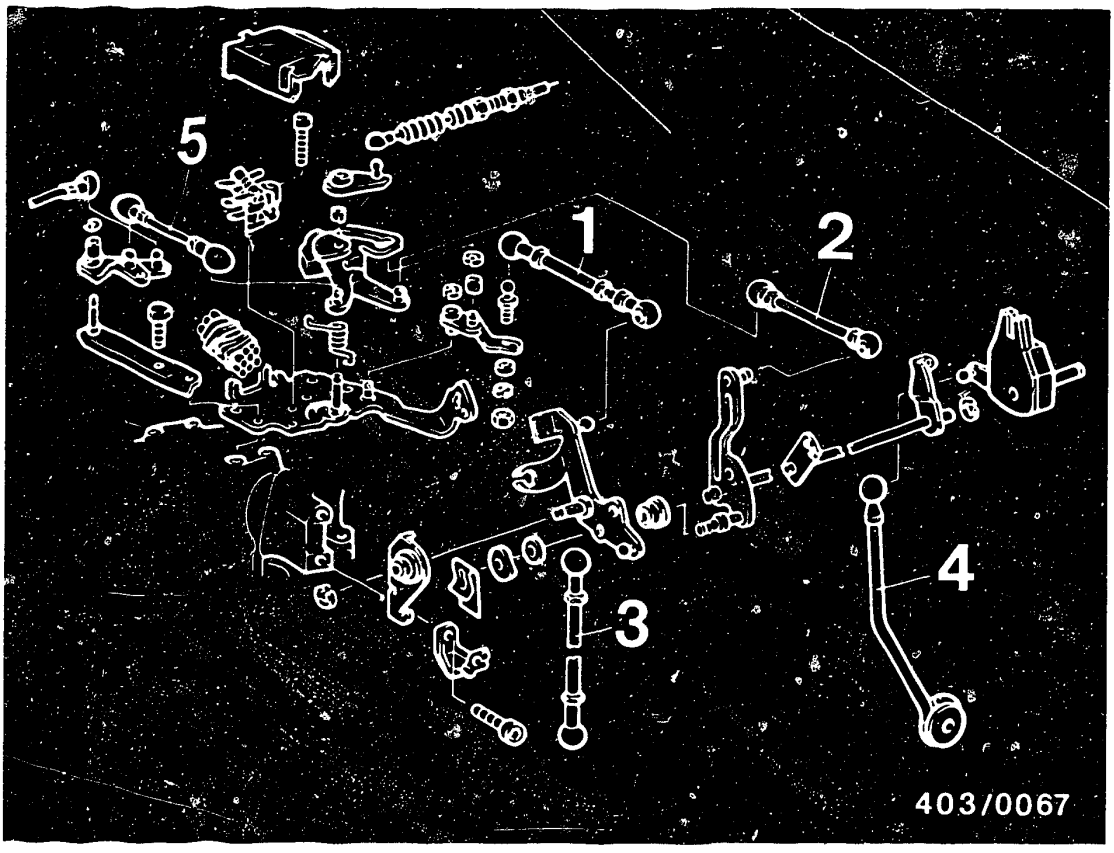
2.16 Adjust accelerator control linkage (setting dimensions) - Type 116 - 1980 model year (California version)

Free-travel rod	(1):	154 mm
Tie rod	(2):	137 mm
Pressure rod	(3):	184 mm

(Dimensions apply from center of ball head to center of ball head)



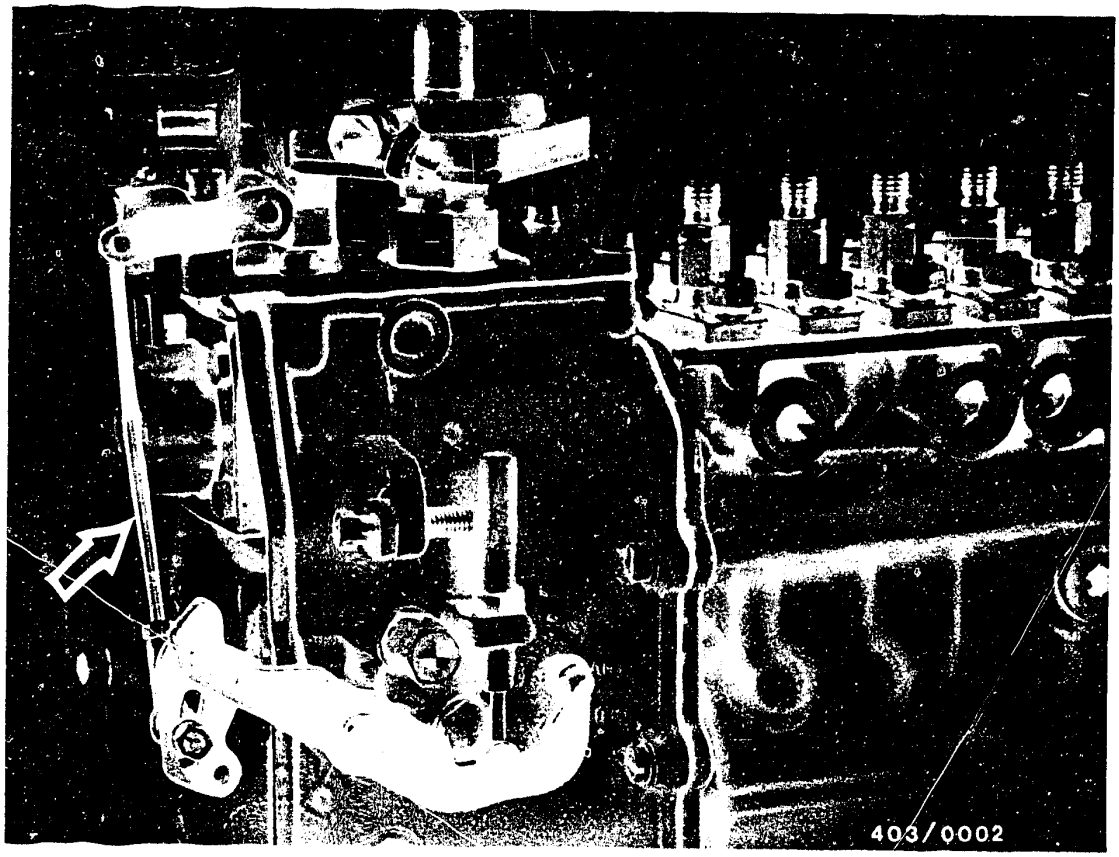
Connecting rod	(4) (in passenger compartment)	122 mm
Tie rod	(5) (on firewall)	68 mm



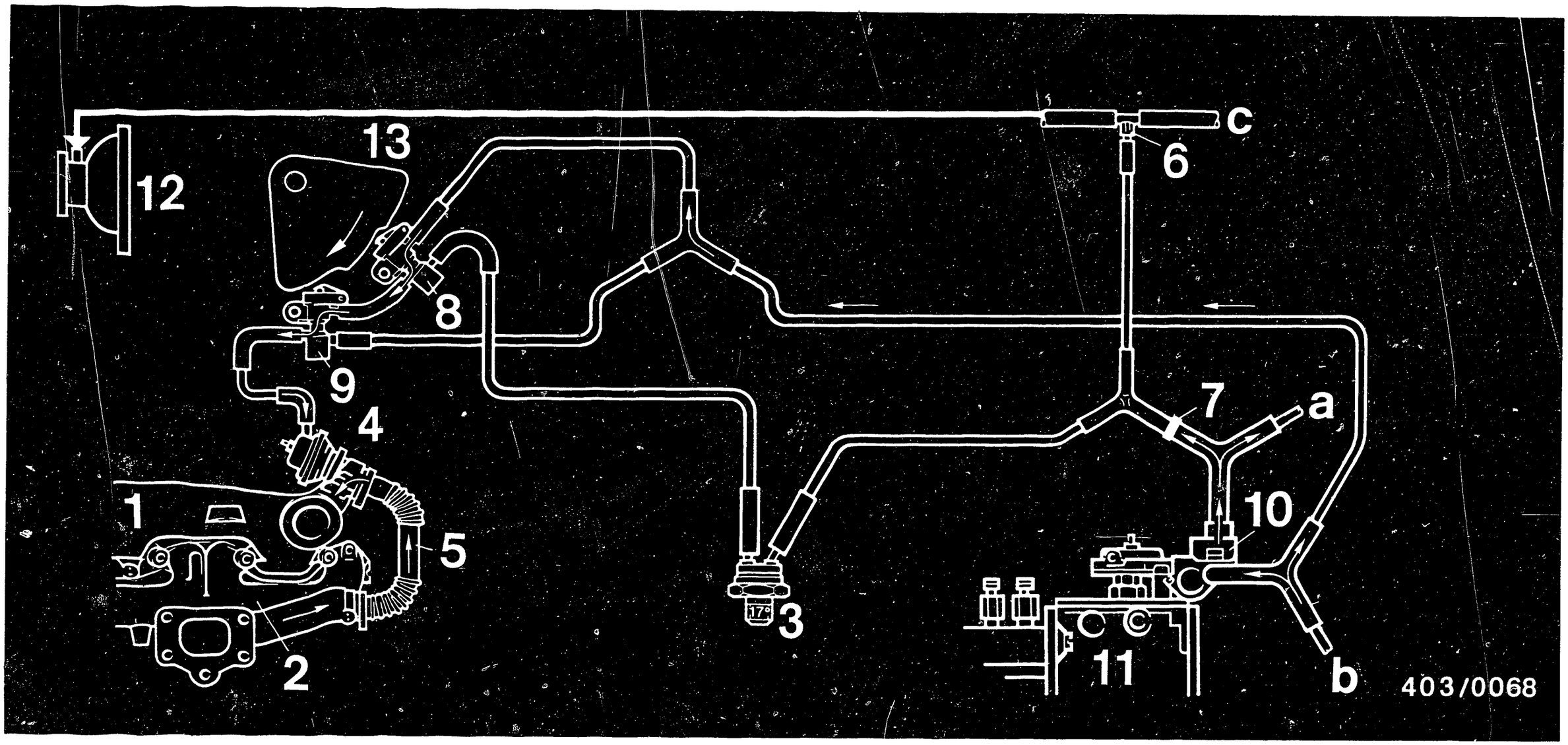
2.17 Adjust accelerator control linkage (setting dimensions) as of 1981 model year

Pressure rod	(1):	160 mm
Tie rod	(2):	100 mm
Pressure rod	(3):	184 mm
Pressure rod	(4):	222 mm
Connecting rod	(5):	196 mm

(Dimensions apply from center of ball head to center of ball head)

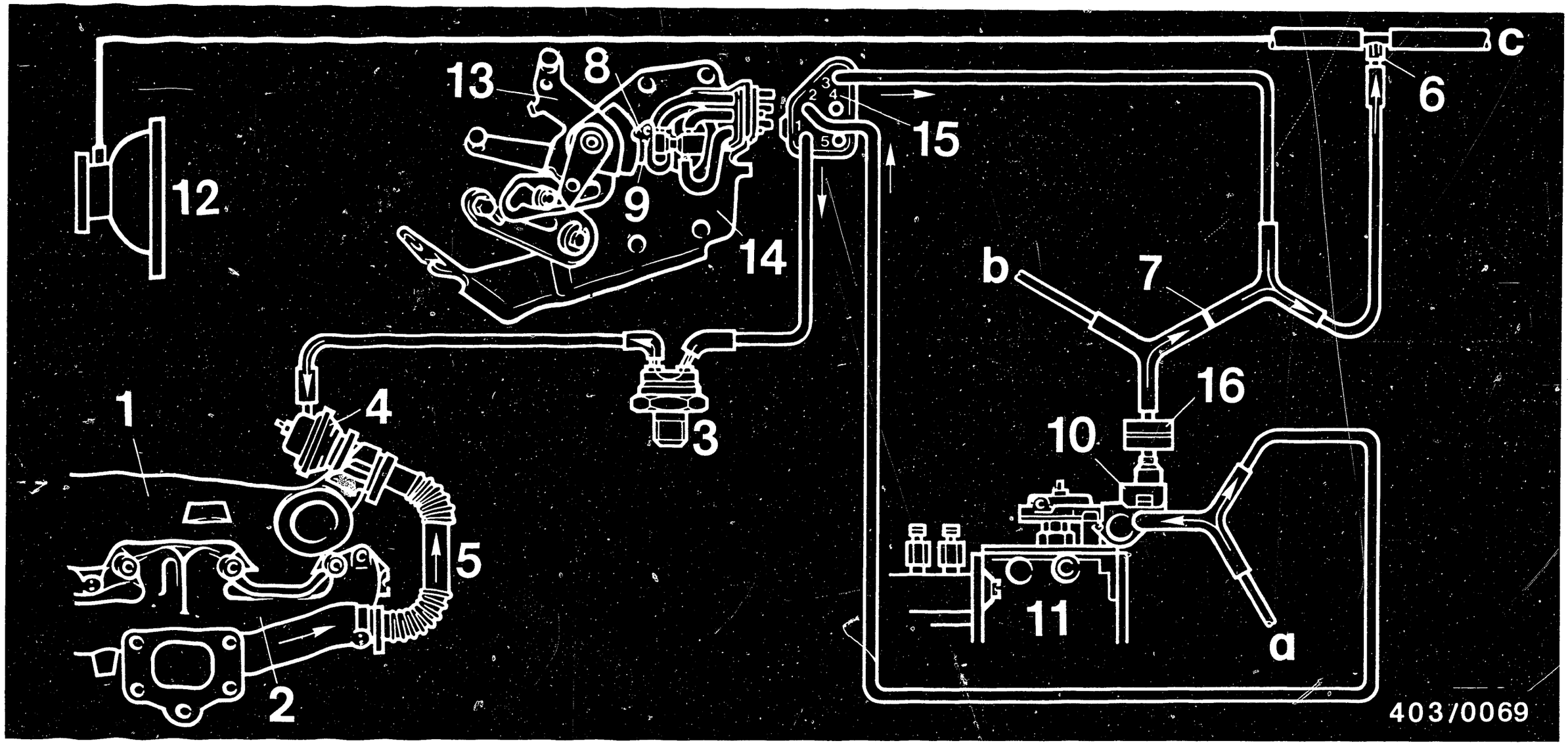


Connecting linkage (arrow)	122 mm



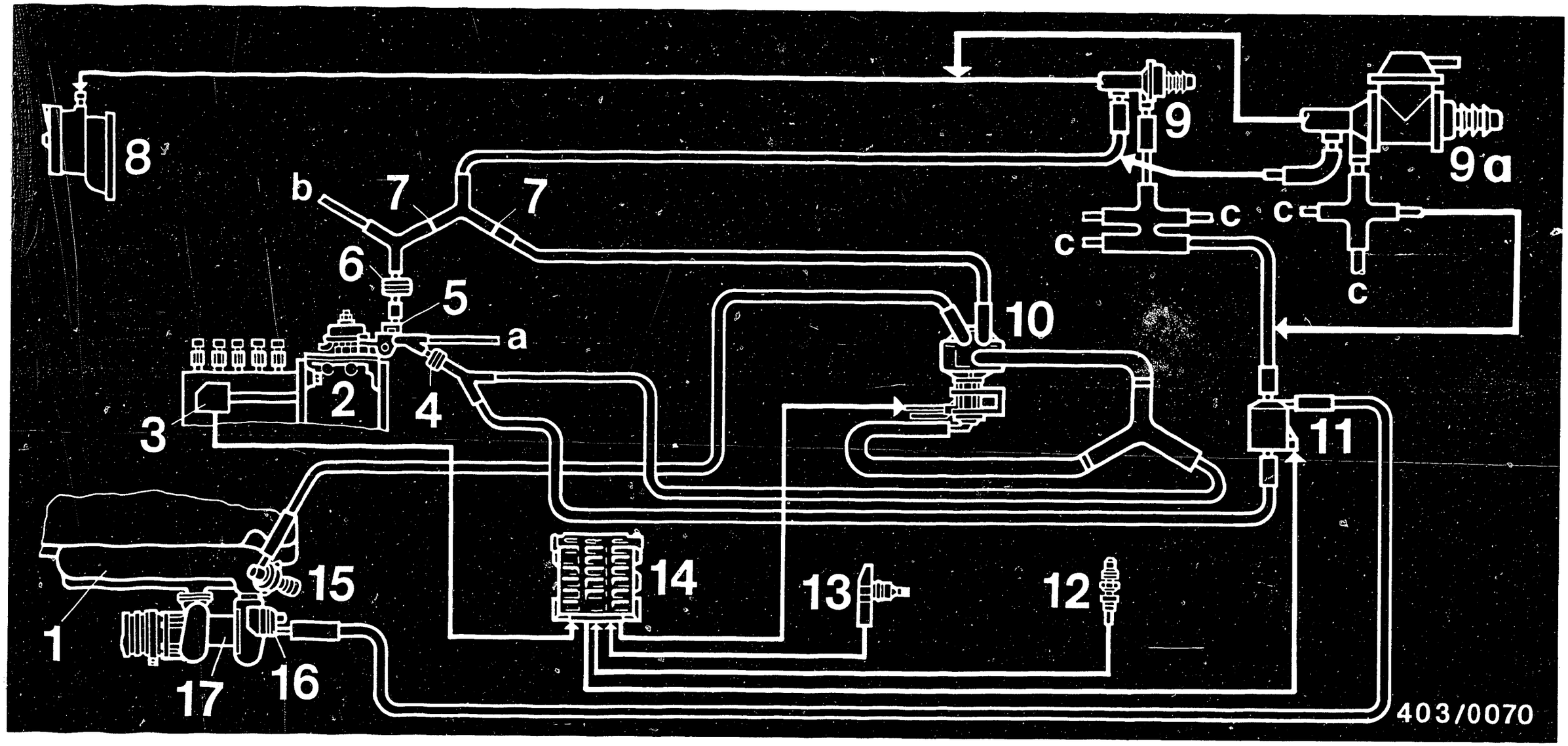
1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 17° thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction
7 = Restriction
8 = Change-over valve - idle cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
a = Automatic transmission
b = Vent to passenger compartment
c = Brake assembly

3. DIAGRAM OF AIR LINES OF EXHAUST-GAS RECIRCULATION - 300 SD (up to 1980 model year)



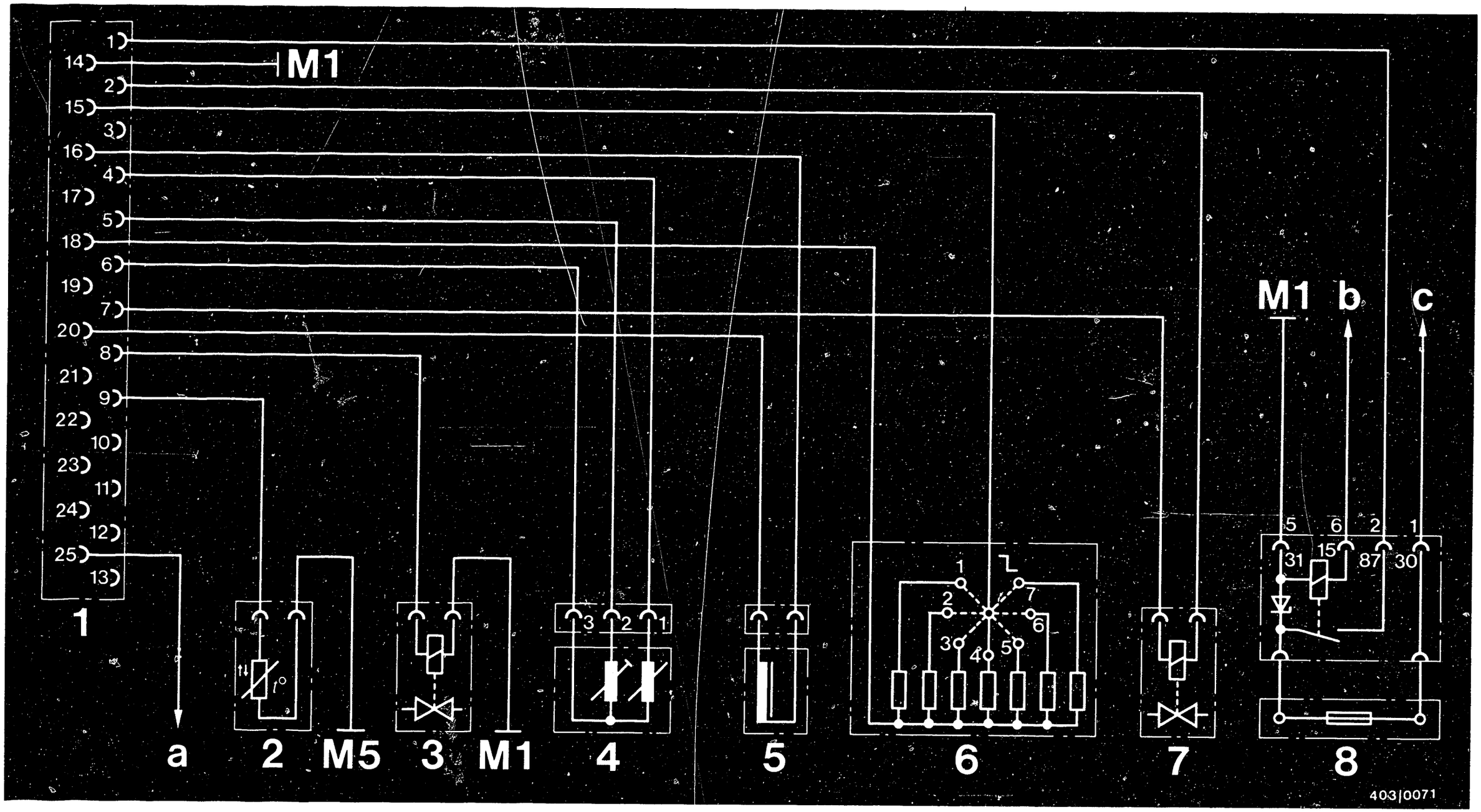
1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 40°C thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction
7 = Restriction
8 = Change-over valve - idle- cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
14 = Valve plate
15 = Central plug
16 = Vacuum damper
a = Vent to passenger compartment
b = Automatic transmission
c = Brake assembly

3.1 Diagram of air lines of exhaust-gas recirculation - 300 SD (model years 81 - 83)



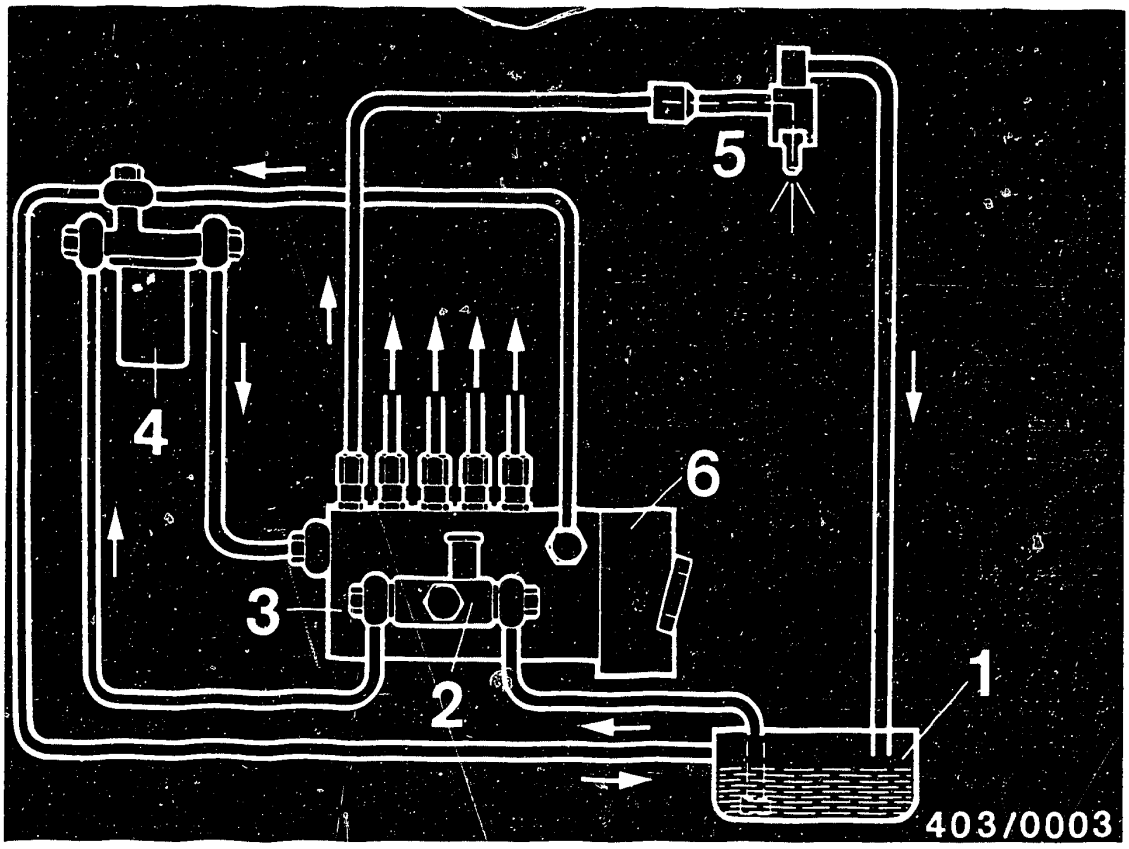
1 = Intake manifold
2 = Fuel-injection pump
3 = Control-rod-travel sensor
4 = Air filter
5 = Vacuum-control valve
6 = Vacuum damper
7 = Restriction 0.5 mm
8 = Vacuum pump
9 = Non-return valve in type 123
9a = Non-return valve in type 126
10 = Pressure transducer
11 = Change-over valve
12 = Coolant temperature sensor
13 = Engine-speed sensor
14 = Control unit
15 = EGR valve
16 = Bypass-air safety valve
17 = Turbocharger

3.2 Diagram of electrical and air lines of exhaust-gas recirculation (84 model year) with control-rod-travel sensor (RWG)



4. ELECTRICAL TERMINAL DIAGRAM (1984 model year)

1 = Control unit
2 = Temperature sensor
3 = Change-over valve
4 = Control-rod-travel sensor
5 = Engine-speed sensor
7 = Pressure transducer
8 = Overvoltage protection
M 1 = Main ground terminal behind instrument cluster
M 5 = Engine ground terminal

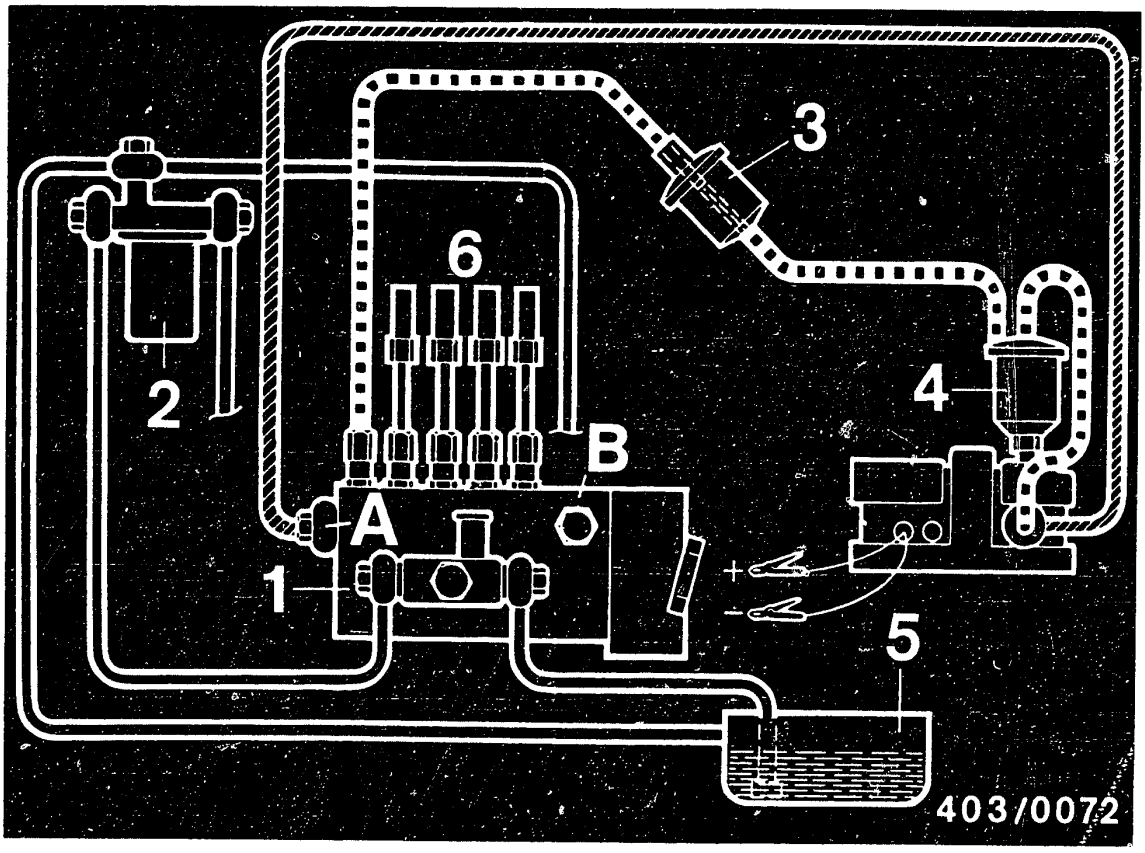


1 = Fuel tank
2 = Supply pump
3 = In-line injection pump
4 = Fuel filter
5 = Injection nozzle
6 = Governor

5. DIAGRAMS OF LINES

5.1 Diagram of fuel lines

The fuel lines are connected according to the above diagram.
The fuel flows in the direction of the arrows.



= Return line

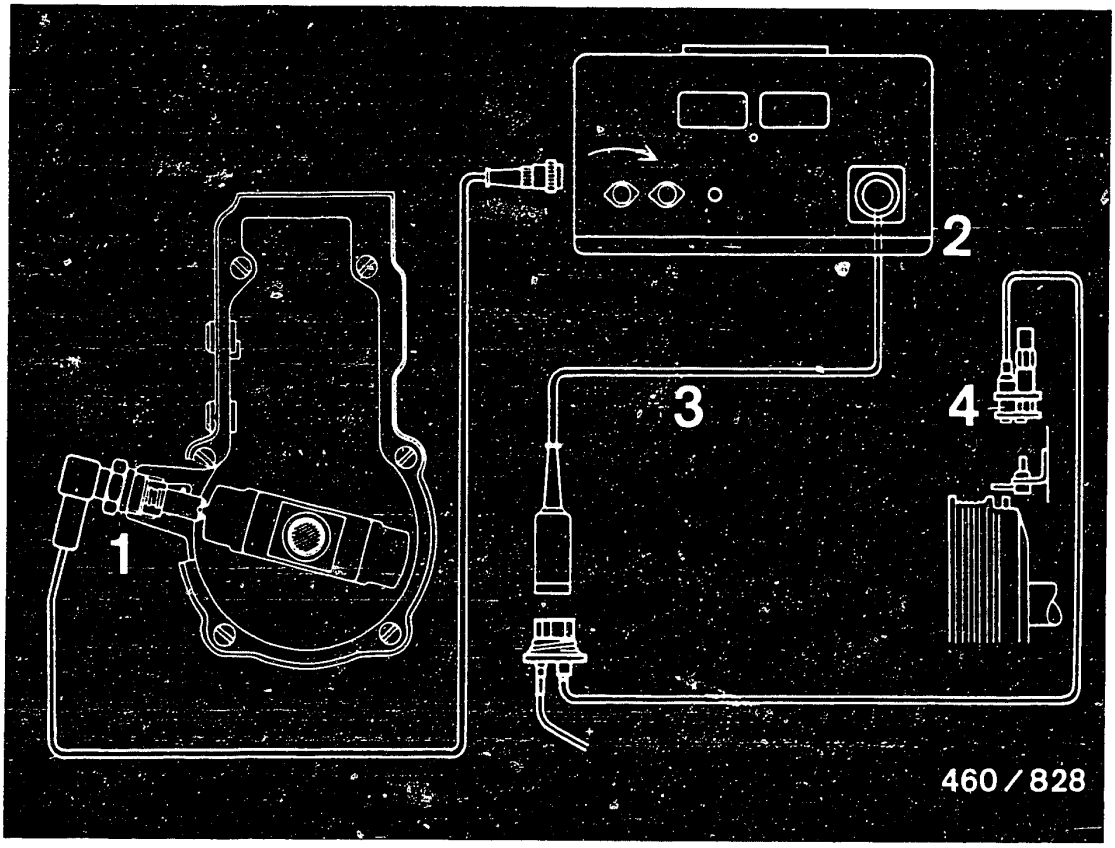
= High pressure approx. 30 + 4 bar

1 = Injection pump
2 = Fuel filter
3 = Sight glass
4 = Start-of-delivery setting device
5 = Fuel tank
6 = Pressure-limiting valves

A = Inlet-union screw, fuel inlet from start-of-delivery setting device
B = Seal fuel return line with screw plug.

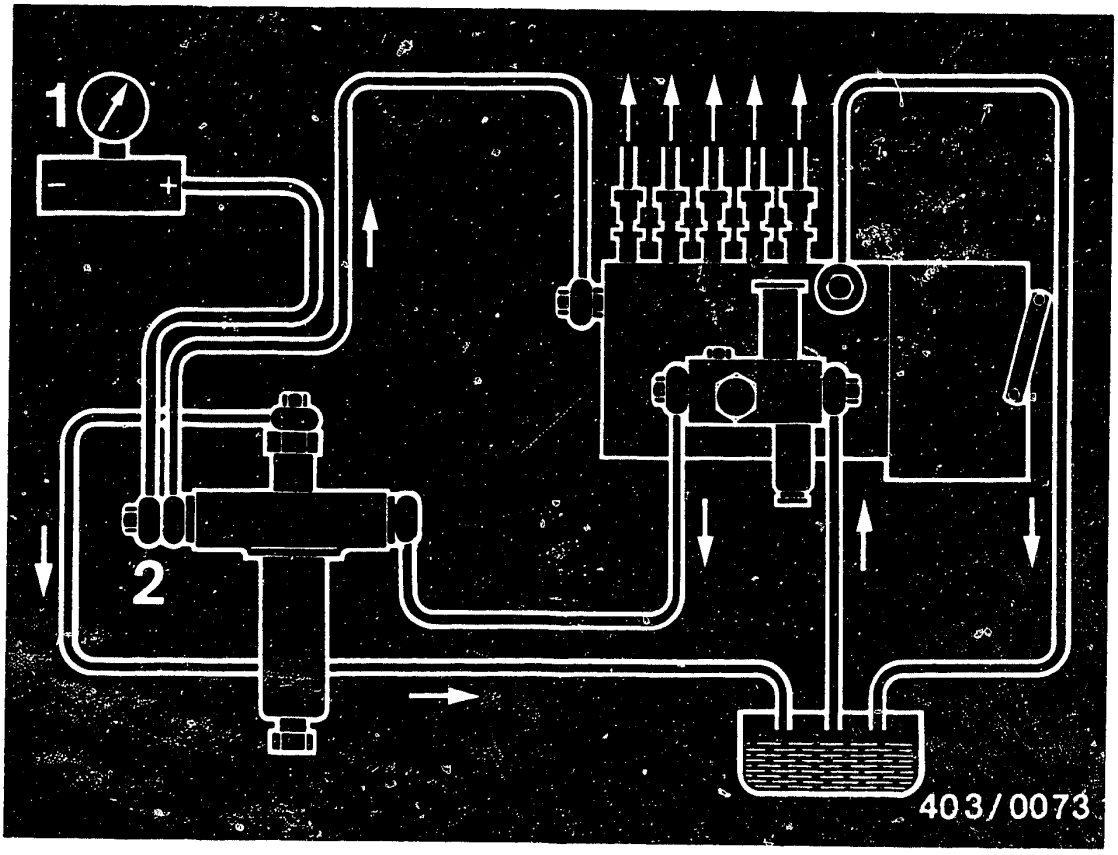
5.2 Connection diagram for setting the start of delivery (static)

High-pressure overflow method



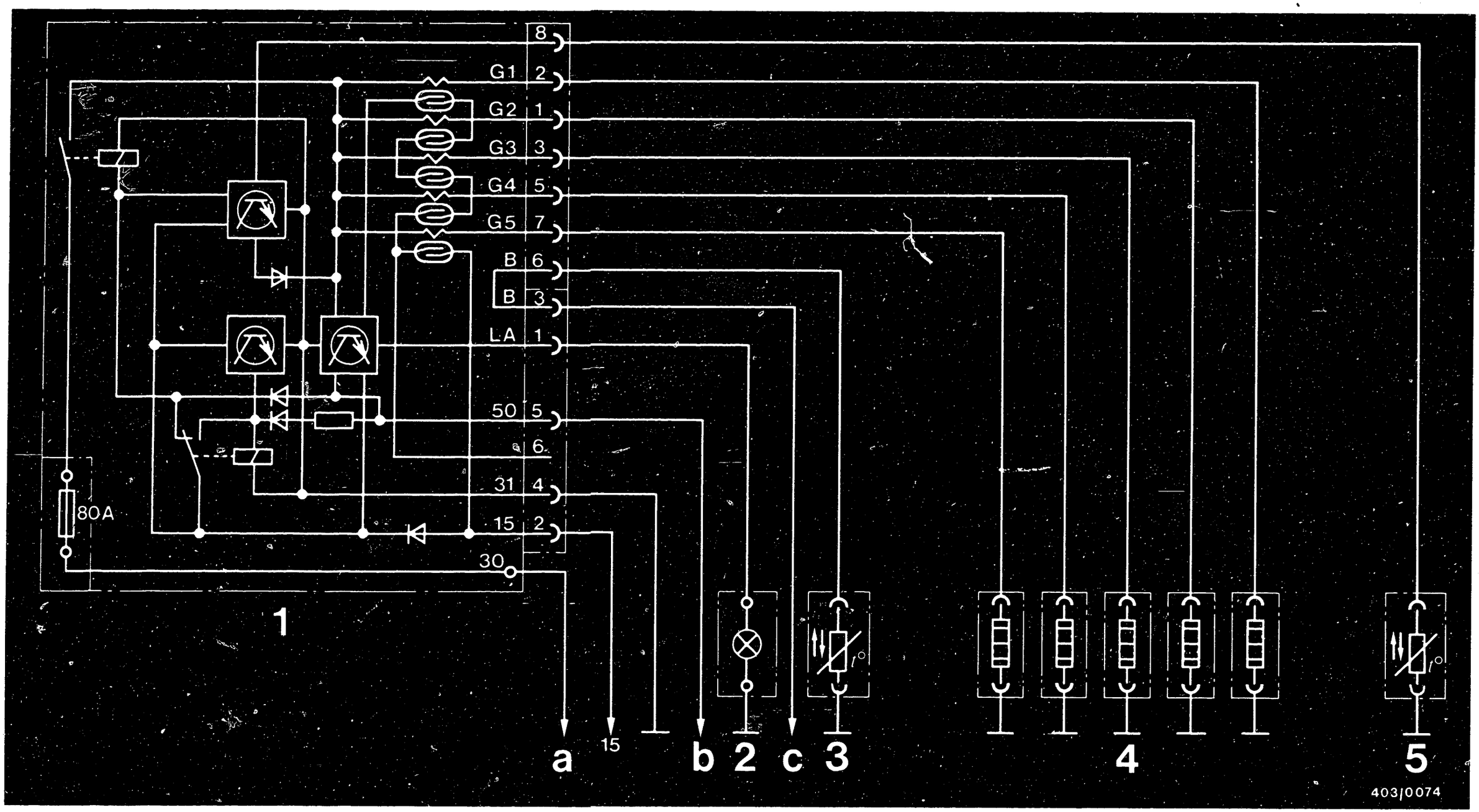
1 = Governor pulse generator
Daimler Benz Part No. 617 589 102 100
2 = Diesel engine tester ETD 019.00
Bosch Part No. 0 684 101 900
3 = Adapter lead
Bosch Part No. 1 684 463 147
4 = TDC pickup (installed in vehicle)

5.3 Connection diagram for dynamic testing of start of delivery with diesel engine tester ETD 019.00



1 = Differential-pressure gauge
2 = Filter outlet (use inlet union and over-long inlet-union screw 2 443 456 020)

5.5 Diagram of fuel lines for checking the delivery pressure

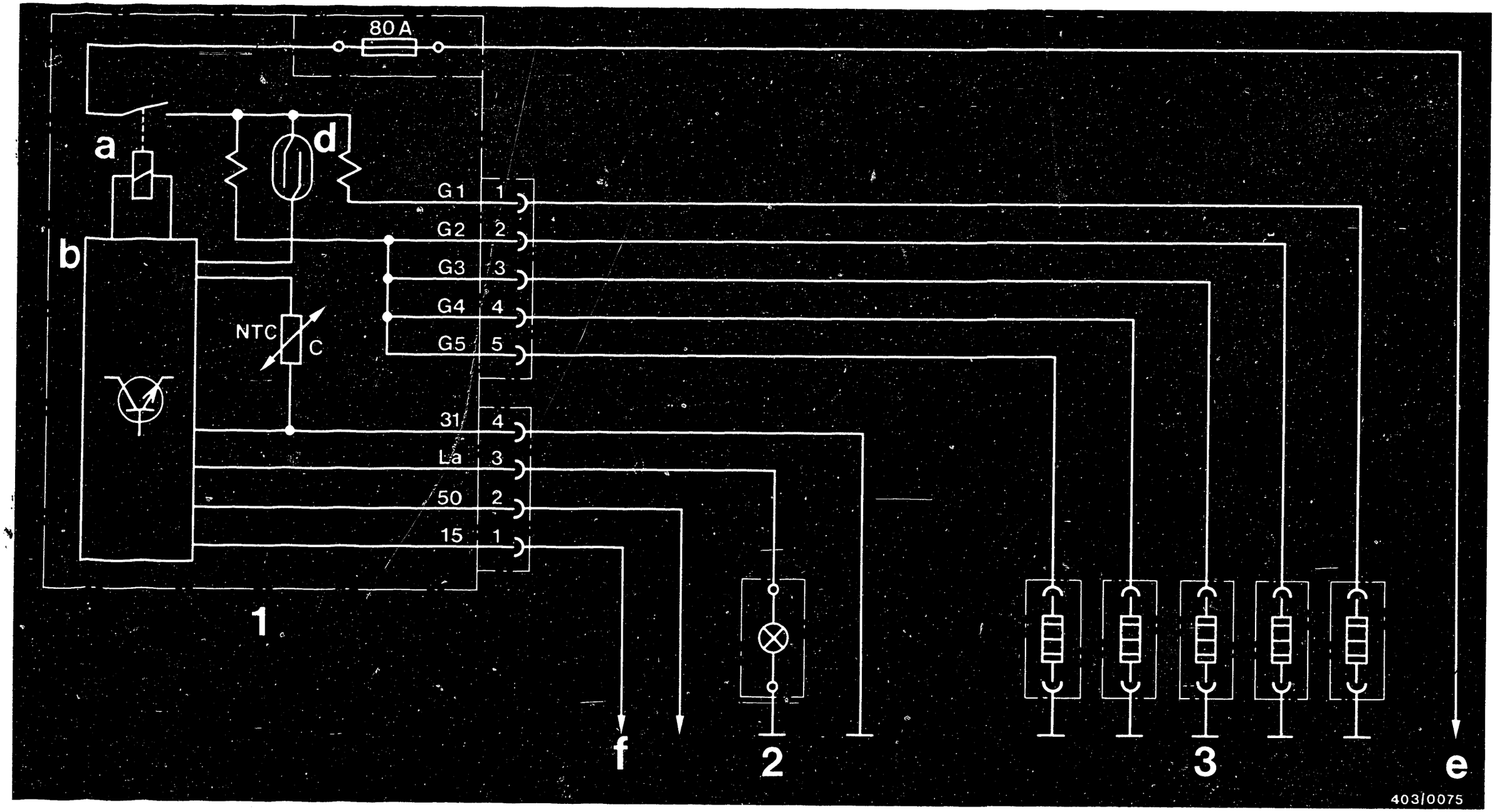


6. CONNECTION DIAGRAM - PREHEATING SYSTEM

6.1 Up to 1980 model year

1 = Glow-duration unit
2 = Glow-plug indicator lamp
3 = Coolant temperature sensor
4 = Sheathed-element glow plugs
5 = Preheating system temperature sensor

a = To cable connector term. 30
b = Relay air conditioner/starting motor term. 30
c = Connection - instr.cluster socket 3



6.2 Circuit diagram - preheating system (as of 1981 model year)

1 = Glow-duration unit
2 = Glow-plug indicator lamp
3 = Sheathed-element glow plugs

e = To cable connector - engine lead set term. 30 in type 123
To support point in fuse box term. 30 in type 126
f = To fuse box term. 15

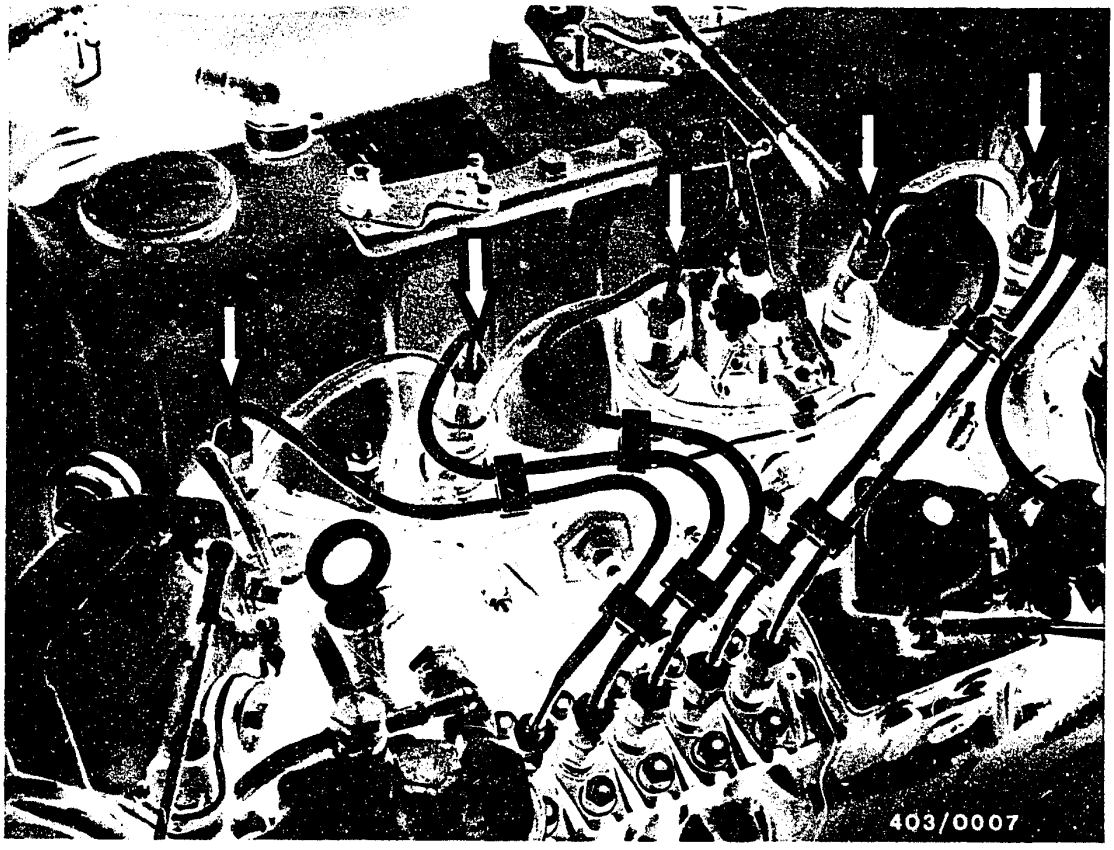
7. TEST EQUIPMENT AND TOOLS

Description	Part number	Use
Nozzle tester	EFEP 60H 0 681 200 502	Testing injection nozzles
Compression tester	Commercially available	Testing engine compression
Compression-loss tester	EFAW 210A 0 681 001 901	Testing engine compression loss
Differential-pressure gauge	Commercially available e.g. Henni NG 160/311-911/ 1.0 + 4 bar Henni u Co. GmbH Nauheimerstr. 72-80 7000 Stuttgart 50	Filter test
Smokemeter Accessories box with metering pump	0 684 102 050 0 681 169 038	Smoke test
Start-of-delivery setting device	KDEP-P 200	Injection timing
Connecting parts for KDEP-P200	KDEP-P200/50	Injection timing
Box wrench	KDEP 1115	Loosening injection lines
Multimeter with digital display	Commercially available	Checking EGR system

Test equipment and tools (continued)

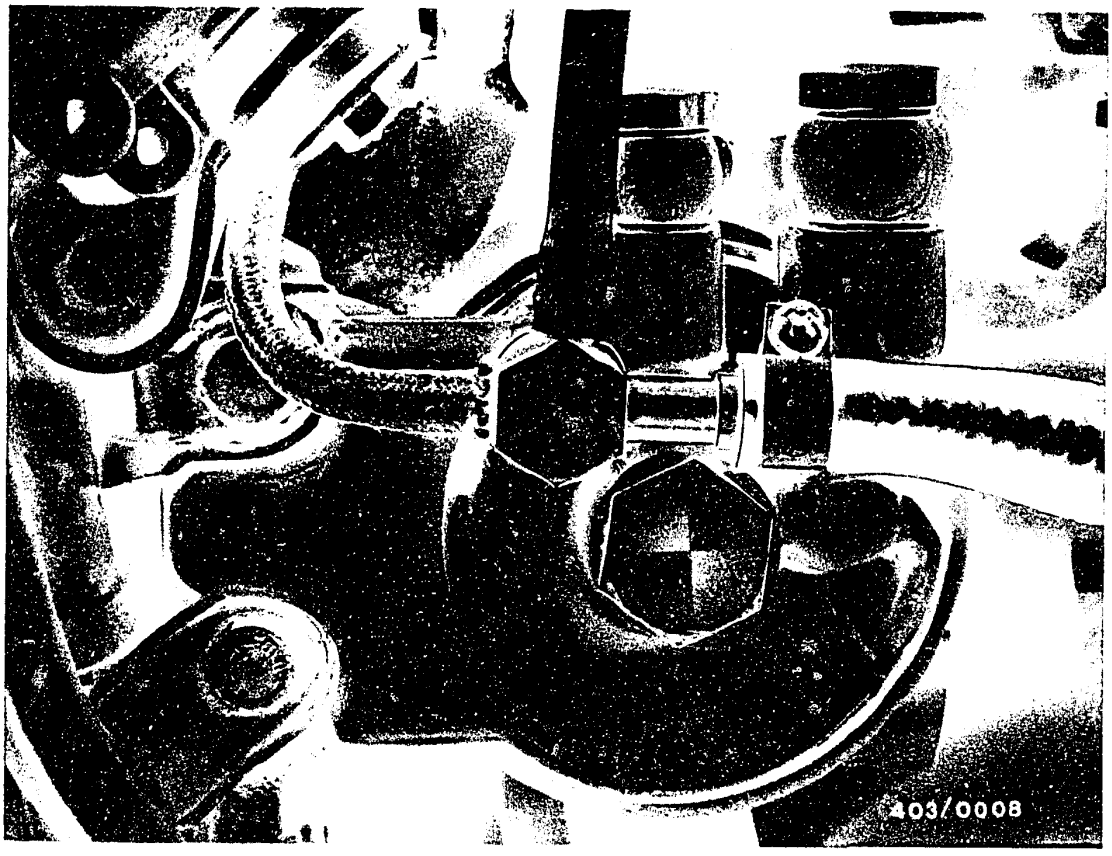
Description	Part number	Use
Motortester with adapter cable	MOT 001.04 1 684 463 094	Engine-speed measurement
Adjusting sleeve	Mercedes-Benz part number 1 800 720 393	Adjusting accelerator control linkage
Pickup	1 687 224 556	Functional test of timing device
Contact-triggered stroboscope	0 681 101 104	Function test of timing device
Needle tester	1 688 200 153	Testing of longitudinal bore
Nozzle cleaning kit	KDEP 2900	For cleaning pintle and hole-type nozzles
Hand vacuum pump "Mityvac"	Korinth Ludwig-Kloos-Straße 21 6450 Hanau 7 (Steinheim)	Leak test on key-operated starting system
Puller	KDEP 1131	For pulling off driver
Pressure-vacuum tester	ETT 007.01	Checking vacuum system
Holding device	KDEP 1077	Locking fly-weight

Description	Part numnber	Use
Diesel engine tester and adapter lead Special accessory: Governor pulse generator	ETD 019.00 1 684 469 147 DB part no.: 617 589 102 100	Dynamic testing of start of delivery
Setting device	Daimler-Benz part number: 617 589 072 100	Dynamic setting of start of delivery



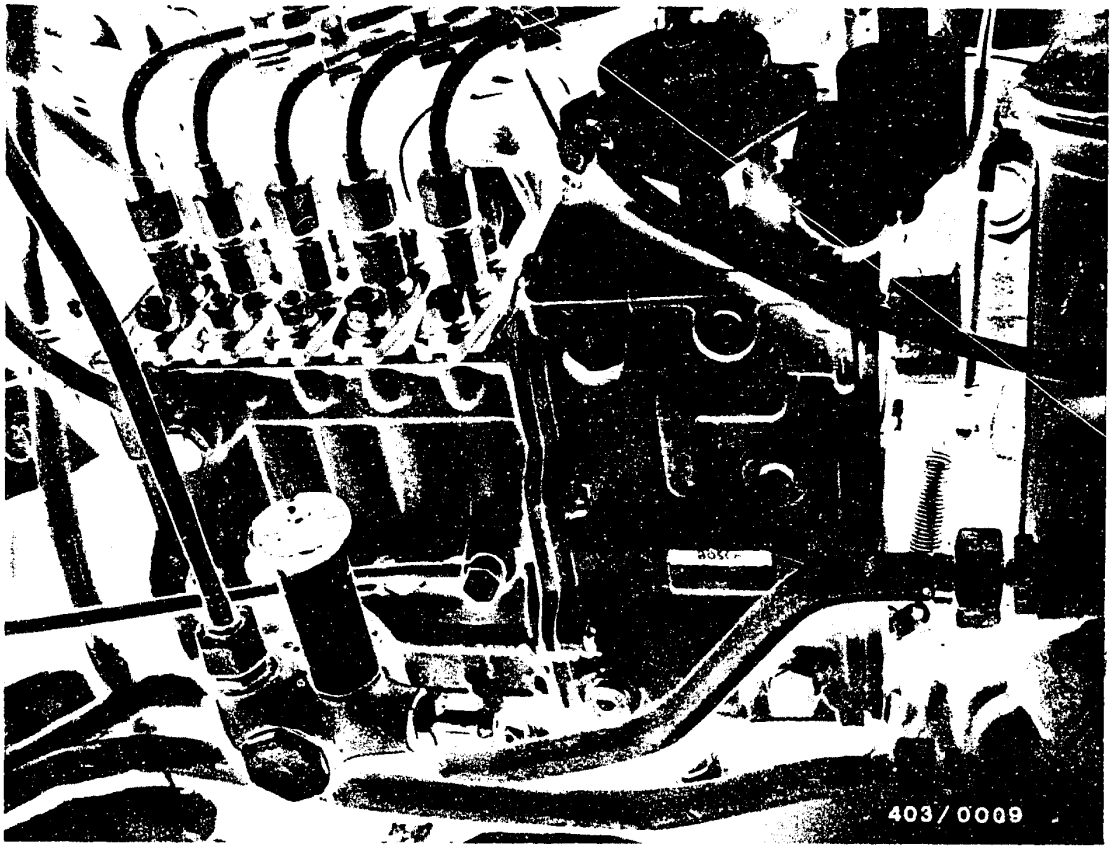
8. INSTALLATION POSITION OF COMPONENTS

8.1 Installation position of injection nozzles



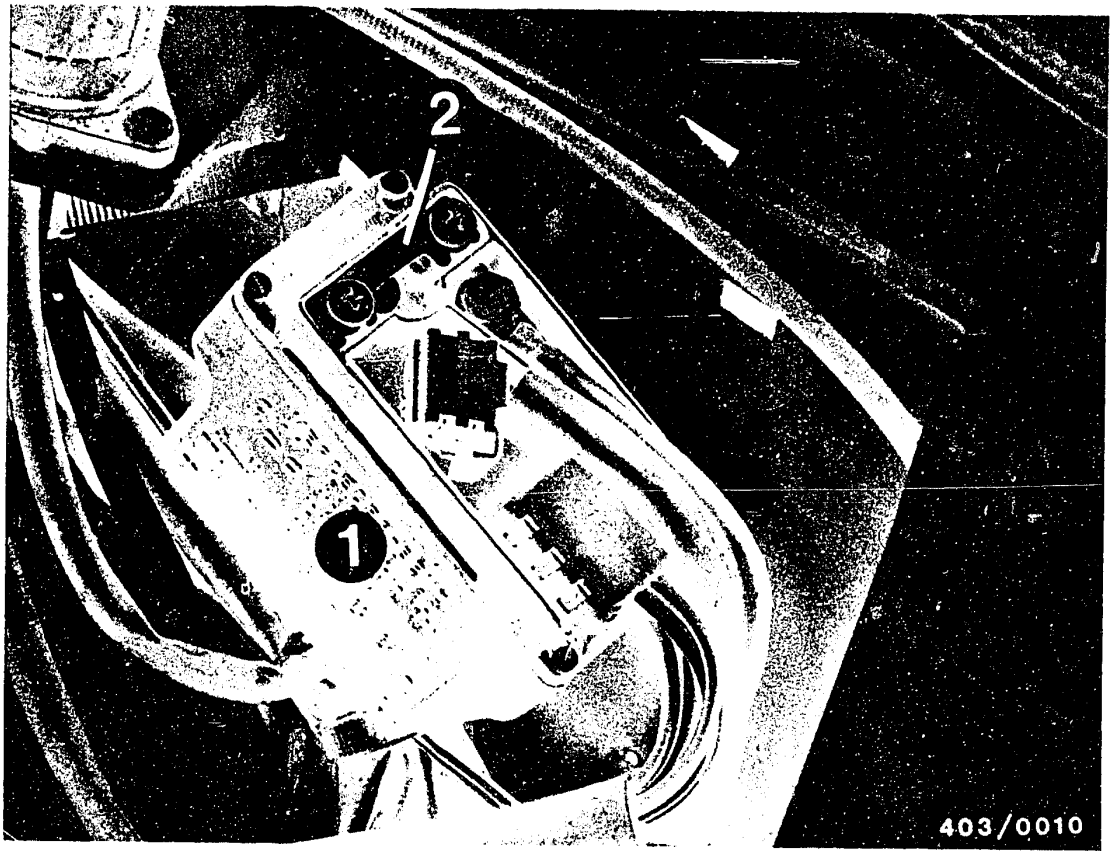
8.2 Installation position of fuel filter

On engine block on left-hand side as viewed in the forward direction of travel.



8.3 Installation position of fuel-injection pump

On engine block on left-hand side as viewed in forward direction of travel.



8.4 Installation position of glow-duration unit

1 = Glow-duration unit
2 = Strip-type fuse (80 A)

In engine compartment at front left.

9. TROUBLE-SHOOTING

Customer complaint (fault symptom)

1. Engine fails to start or starts only with difficulty when warm	2. Engine fails to start or starts only with difficulty when cold	3. Engine hunts at idle	4. Rough idle with engine warm	5. Engine missing during vehicle operation (part load)	6. Unsatisfactory performance	7. Engine bucking at full load	Cause	Coordinates
●	●			●			Tank empty; tank vent clogged	C 9
●	●	●	●	●	●		Injection sequence does not correspond to firing sequence (check routing of fuel-injec.tubing)	C 10
●	●		●	●		●	Air in fuel system	C 12
	●			●			Heavy paraffin deposits in filter	C 15
●	●		●	●	●	●	Connections loose; lines leaking or broken (check fuel lines)	C 17
●	●			●	●		Supply lines clogged	C 19
●	●		●	●			Injection lines clogged or constricted (check fuel lines)	C 19
					●	●	Engine air filter clogged	D 7
		●	●				Idle speed incorrect; adjust accelerator control linkage	D 8
							Vacuum system defective	E 7
●	●		●	●	●	●	Injection nozzle defective	E 10
●	●			●	●	●	Fuel filter clogged	E 19
			●				Exhaust-gas recirculation defective	J 16

Customer complaint (fault symptom) (continued)

1. Engine fails to start or starts only with difficulty when warm	2. Engine fails to start or starts only with difficulty when cold	3. Engine hunts at idle	4. Rough idle with engine warm	5. Engine missing during vehicle operation (part load)	6. Unsatisfactory performance	7. Engine bucking at full load	Cause	Coordinates
●	●			●	●	●	Fuel delivery pressure incorrect	E 19
	●		●				Valves leaking	E 19
●	●			●	●		Overflow valve clogged	E 19
	●						Preheating system defective	F 3
					●		Engine compression poor or uneven	G 1
●	●		●	●	●	●	Injection timing incorrect	J 1
					●	●	Timing device defective	H 16
					●		Maximum engine speed incorrectly adjusted (remove fuel-injection pump)	G 13
●	●	●	●	●	●	●	Injection pump (governor) defective or out of adjustment (remove fuel-injection pump)	G 13
					●	●	Check turbocharger for leaks and charge-air pressure	J 9
					●		Connecting hose leaking	J 12
				●			Check pressure switch and change-over valve	J 13
			●				Exhaust-gas recirculation defective	J 16

Customer complaint (fault symptom) (continued)

8. Fuel consumption too high	9. Engine will not stop or does not stop immediately	10. Engine runs rough; black smoke in full-load range; lack of power	11. Fog-like smoke in full-load range (white)	12. Incorrect engine speed	13. Engine will not accelerate when cold	14. Injection pump overheating	Cause	Coordinates
							Tank empty; tank vent clogged	C 9
		●	●		●		Injection sequence does not correspond to firing sequence (check routing of fuel-injec.tubing)	C 10
							Air in fuel system	C 12
						●	Heavy paraffin deposits in filter	C 15
●		●	●		●		Connections loose; lines leaking or broken (check fuel lines)	C 17
						●	Supply lines clogged	C 19
		●					Injection lines clogged or constricted (check fuel lines)	C 19
●		●					Engine air filter clogged	D 7
				●			Idle speed incorrect; adjust accelerator control linkage	D 8
	●						Vacuum system defective	E 7
●		●	●		●		Injection nozzle defective	E 10
							Fuel filter clogged	E 19
		●					Exhaust-gas recirculation defective	J 16
		●					Check soot burn-off filter	M 15

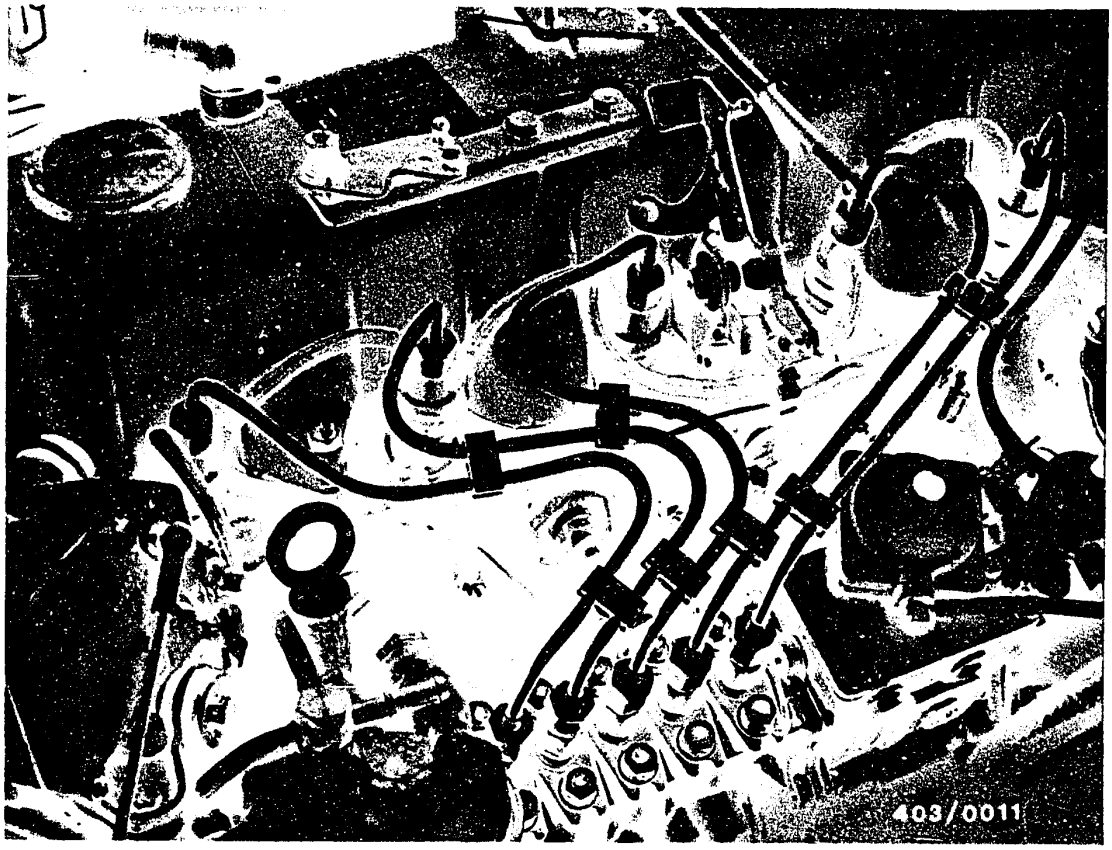
Customer complaint (fault symptom) (continued)

8. Fuel consumption too high
9. Engine will not stop or does not stop immediately
10. Engine runs rough; black smoke in full-load range; lack of power
11. Fog-like smoke in full-load range (white)
12. Incorrect engine speed
13. Engine will not accelerate when cold
14. Injection pump overheating

8	9	10	11	12	13	14	Cause	Coordinates
							Fuel delivery pressure incorrect	E 19
							Valves leaking	E 19
					●		Overflow valve clogged	E 19
							Preheating system defective	F 3
		●	●				Engine compression poor or uneven	G 1
●		●	●		●		Injection timing incorrect	J 1
●		●	●		●		Timing device defective	H 16
				●			Maximum engine speed incorrectly adjusted (remove fuel-injection pump)	G 13
●	●	●	●	●	●	●	Injection pump (governor) defective or out of adjustment (remove fuel-injection pump)	G 13
							Check turbocharger for leaks and charge-air pressure	J 9
							Connecting hose leaking	J 12
							Check pressure switch and change-over valve	J 13
		●					Exhaust-gas recirculation defective	J 16
		●					Check soot burn-off filter	M 15

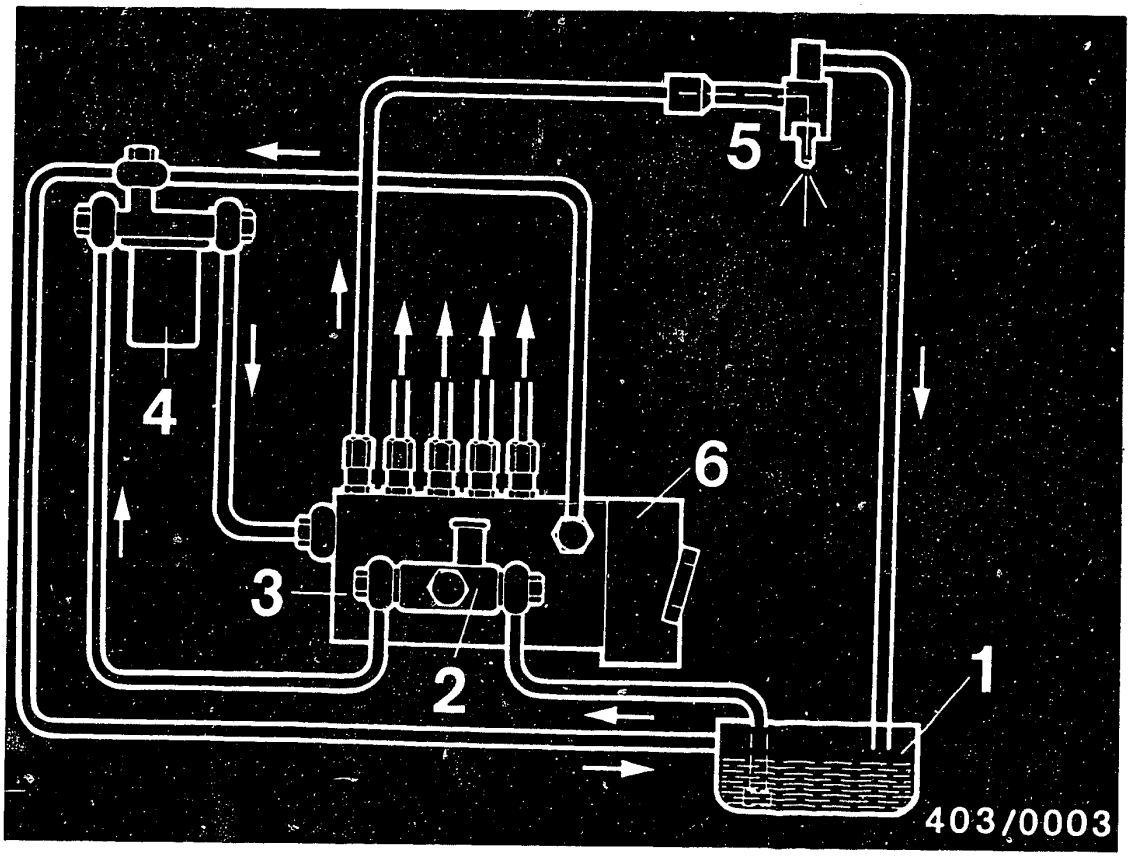
10. CHECK TANK VENT

Open tank filler cap.
If, after opening the tank filler cap, the fault disappears, the tank vent is defective.
Check for clogging in tank vent cup seal on right-hand side on floor of frame in front of rear axle suspension.



11. CHECK ROUTING OF FUEL-INJECTION TUBING

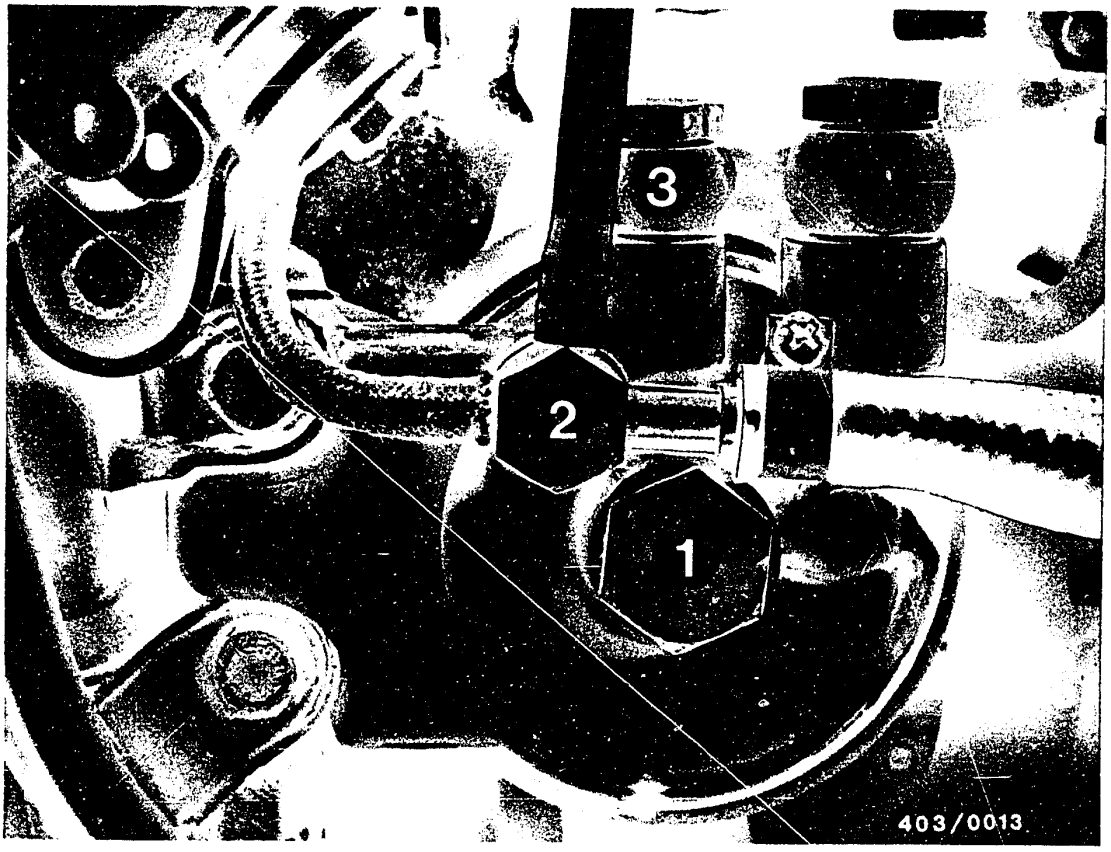
The fuel-injection lines are held together by clamps so that it is not possible to mix up the outlets. If, nevertheless, there is doubt, check the routing of the lines according to the above picture.



1 = Fuel tank
2 = Supply pump
3 = In-line injection pump
4 = Fuel filter
5 = Injection nozzles
6 = Governor

12. DIAGRAM OF FUEL LINES

The fuel lines are connected according to the above diagram.
The fuel flows in the direction of the arrows.



1 = Screw plug
2 = Central screw plug
3 = Inlet-union screw

13. BLEED FUEL SYSTEM

Fill fuel filter and fuel-injection pump with diesel fuel.

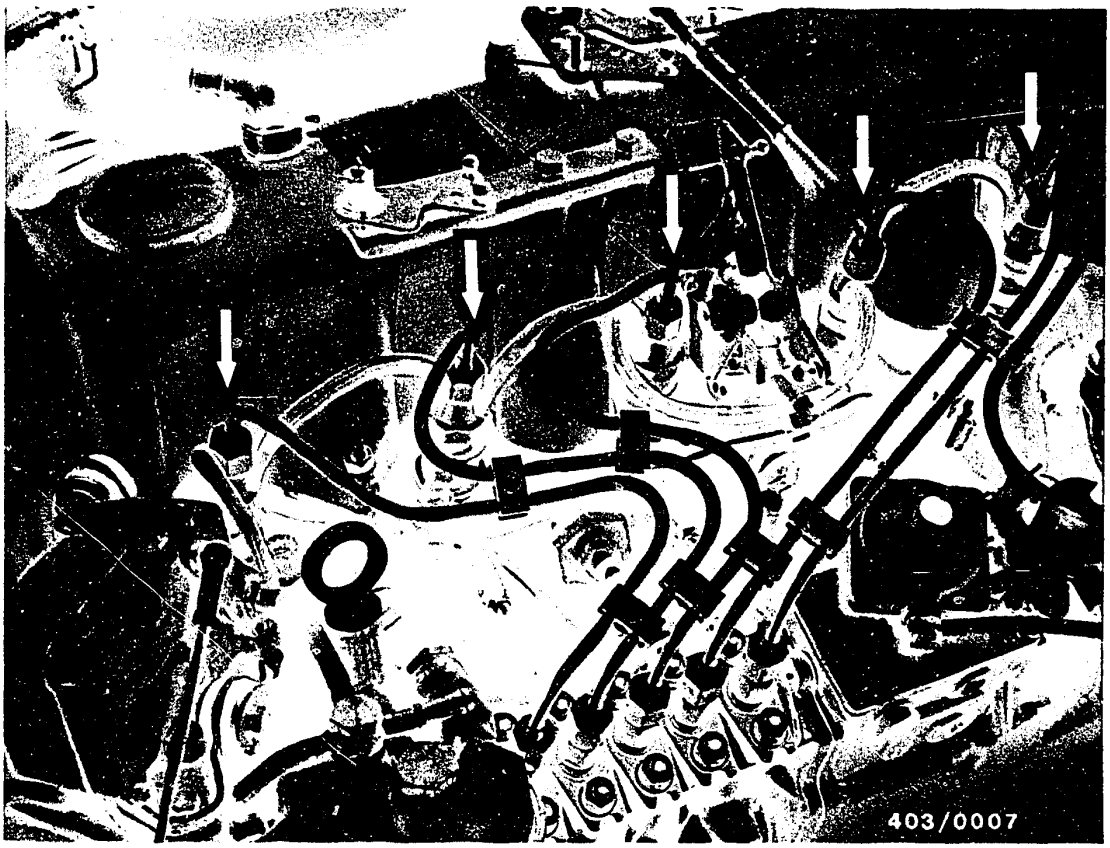
Loosen inlet-union screw on fuel filter.

Loosen actuating knob of hand primer and operate hand primer until fuel escaping from inlet-union screw is free of bubbles.
Re-tighten inlet-union screw.

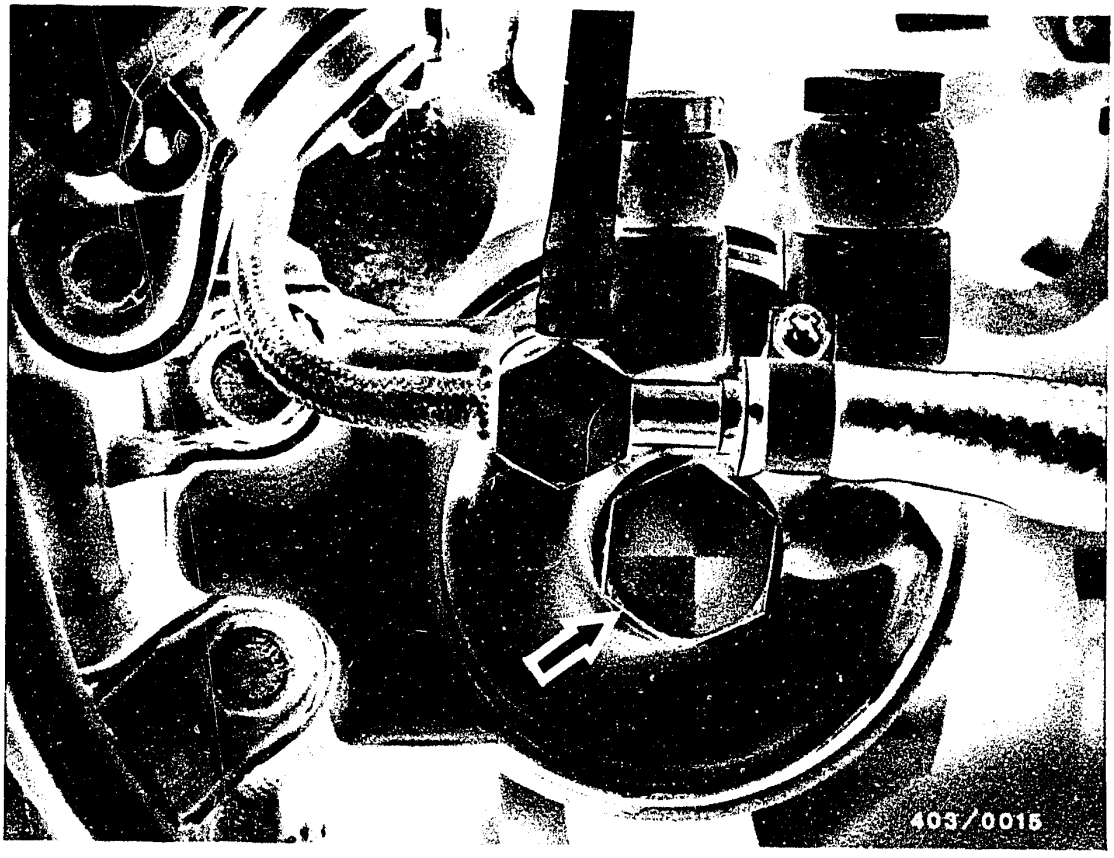
Continue to operate hand primer until the overflow valve on the injection pump opens (audible chattering noise).

Screw down actuating knob on hand primer.

This presses the pump plunger onto a seal ring, thereby sealing the hand primer externally.
If the actuating knob is loose, the hand primer leaks during operation with the result that air can get into the fuel system.

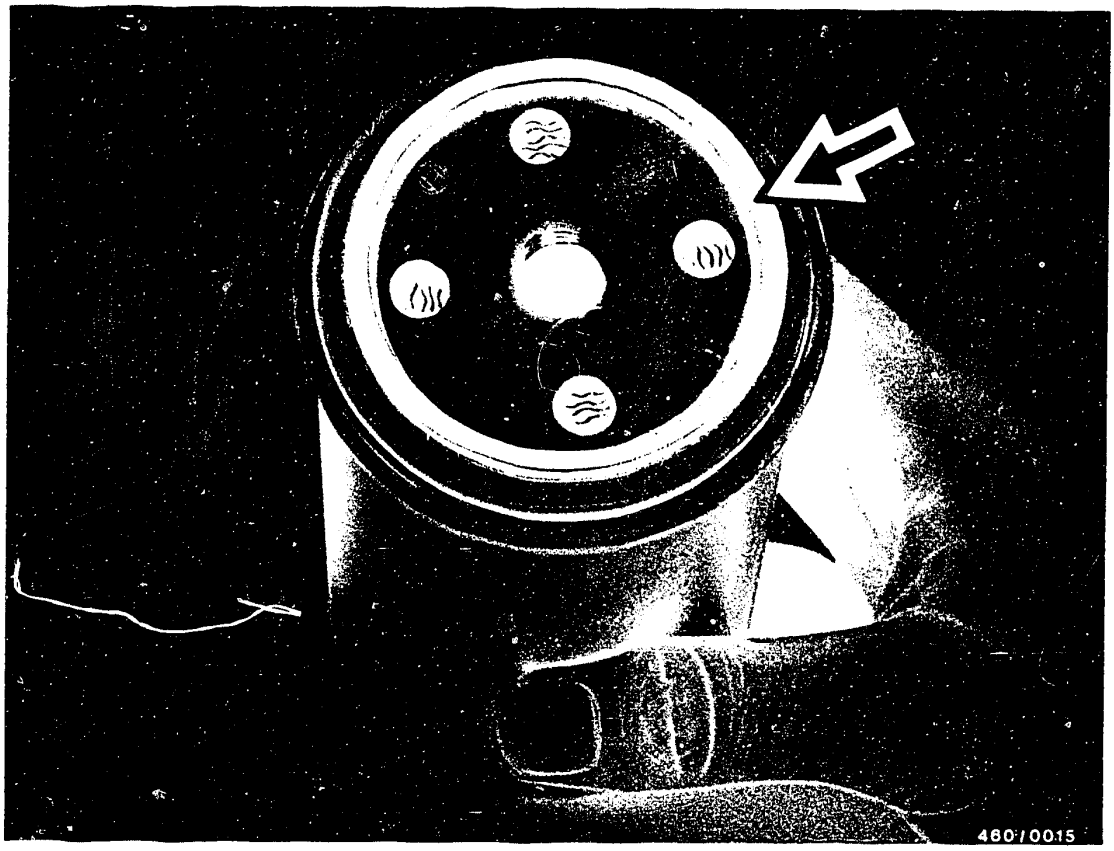


Loosen union nuts of fuel-injection tubing on injection-nozzle holders.
Operate engine starting motor without preheating until fuel escapes from union nuts of injection-nozzle holders.
Tighten union nuts.
Operate starting motor until engine starts.

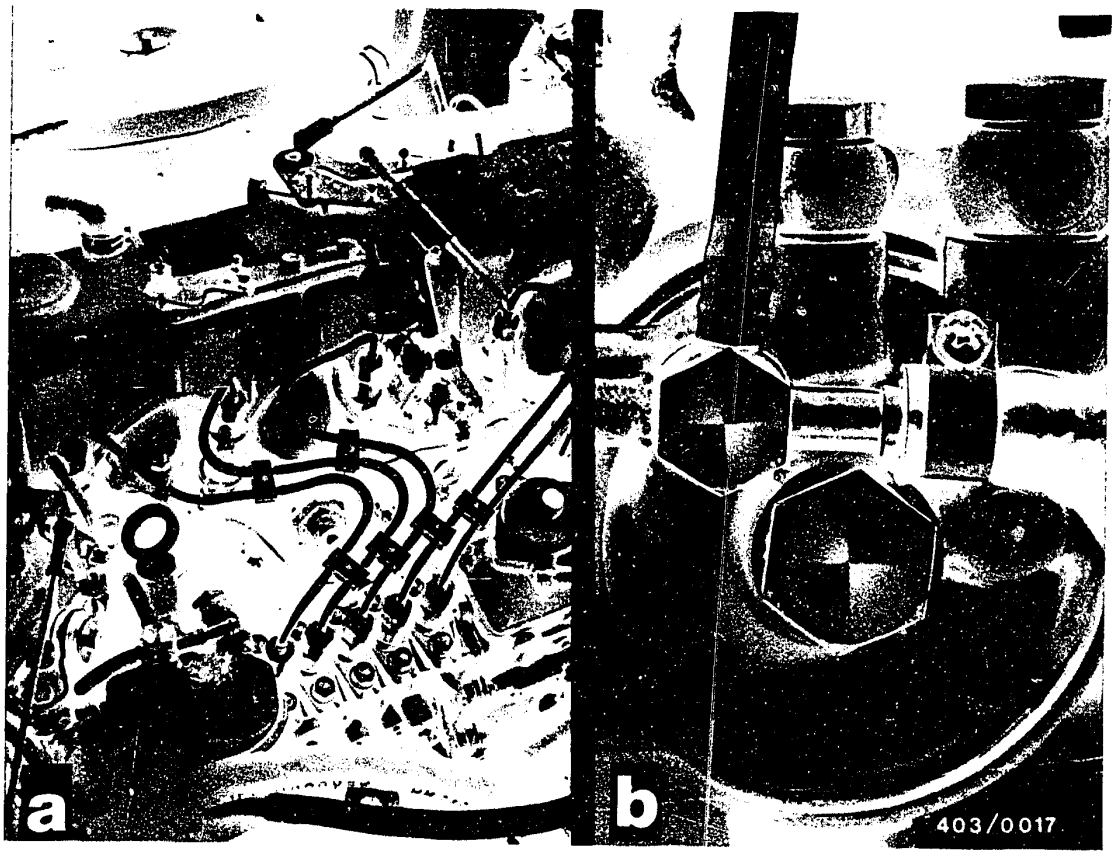


14. REPLACE FILTER BOX

Loosen fasten screw (arrow) and unscrew filter cover. Catch escaping fuel.



Rub diesel fuel into rubber seal ring (arrow) of new filter box.
Screw filter box by hand into cover and tighten.
Check fuel filter for leaks.



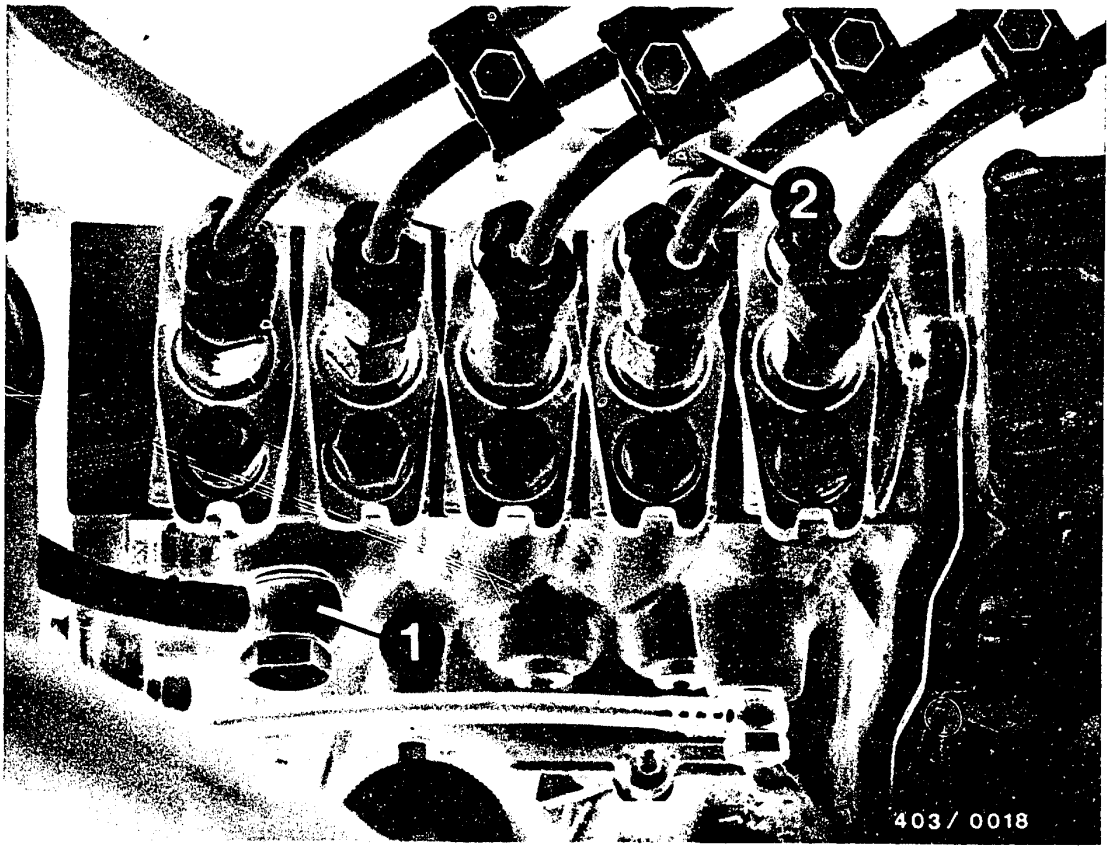
15. CHECK INJECTION SYSTEM FOR LEAKS

The leak test is to be performed with the engine at normal operating temperature.

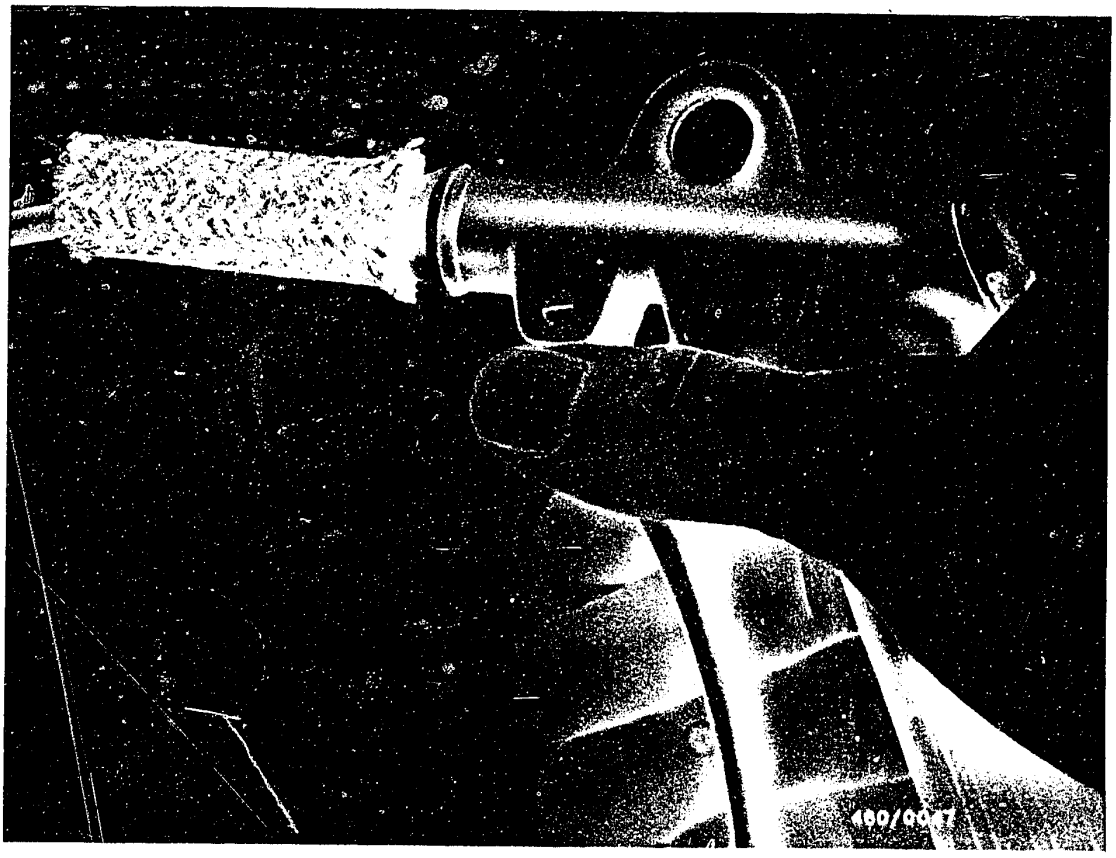
During the leak test, check all connection points of the fuel lines.

Pay particular attention to:

- Connections at the injection-nozzle holders (picture a)
- Connections on the fuel filter (picture b)



- Delivery-valve holders at the individual outlets. Perform visual examination of fuel lines for hairline cracks.
- Inlet line (1) and return line (2) on injection pump.



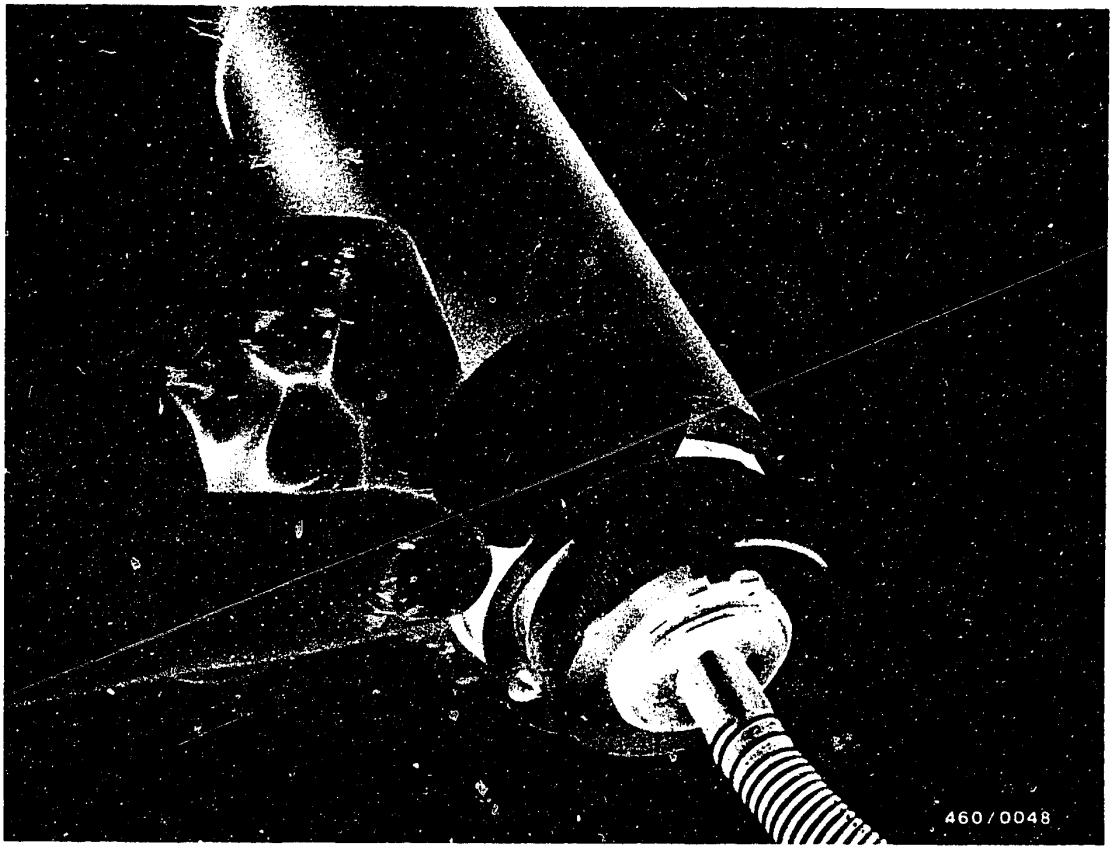
16. CHECK FUEL LINES

Perform visual examination on suspect fuel lines.

If pinching or kinking is detectable, remove the suspect fuel line.

Check fuel line for throughflow with compressed air and clean, if necessary.

For blowing through the fuel lines, it is possible to use a suitable hose-piece as a side seal.



17. SMOKE TEST

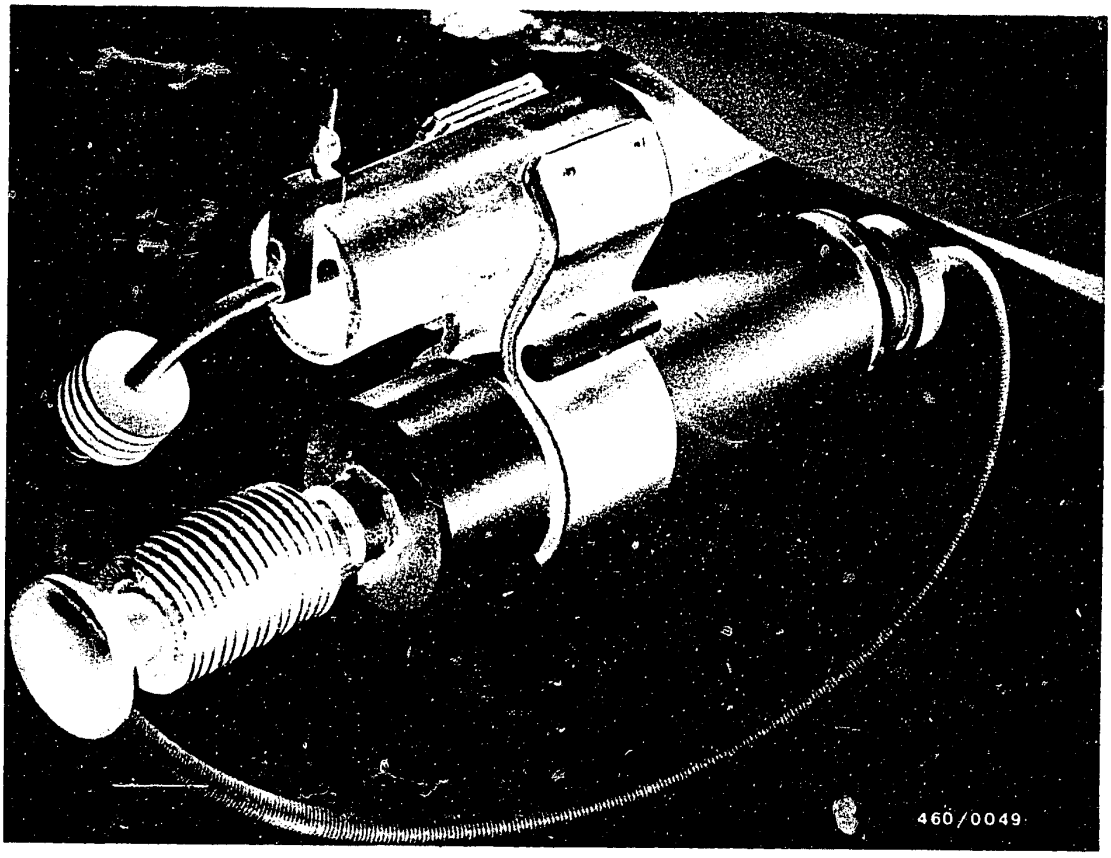
17.1 Test setup

The smoke test is performed with the BOSCH smokemeter.

The smokemeter consists of the following equipment:

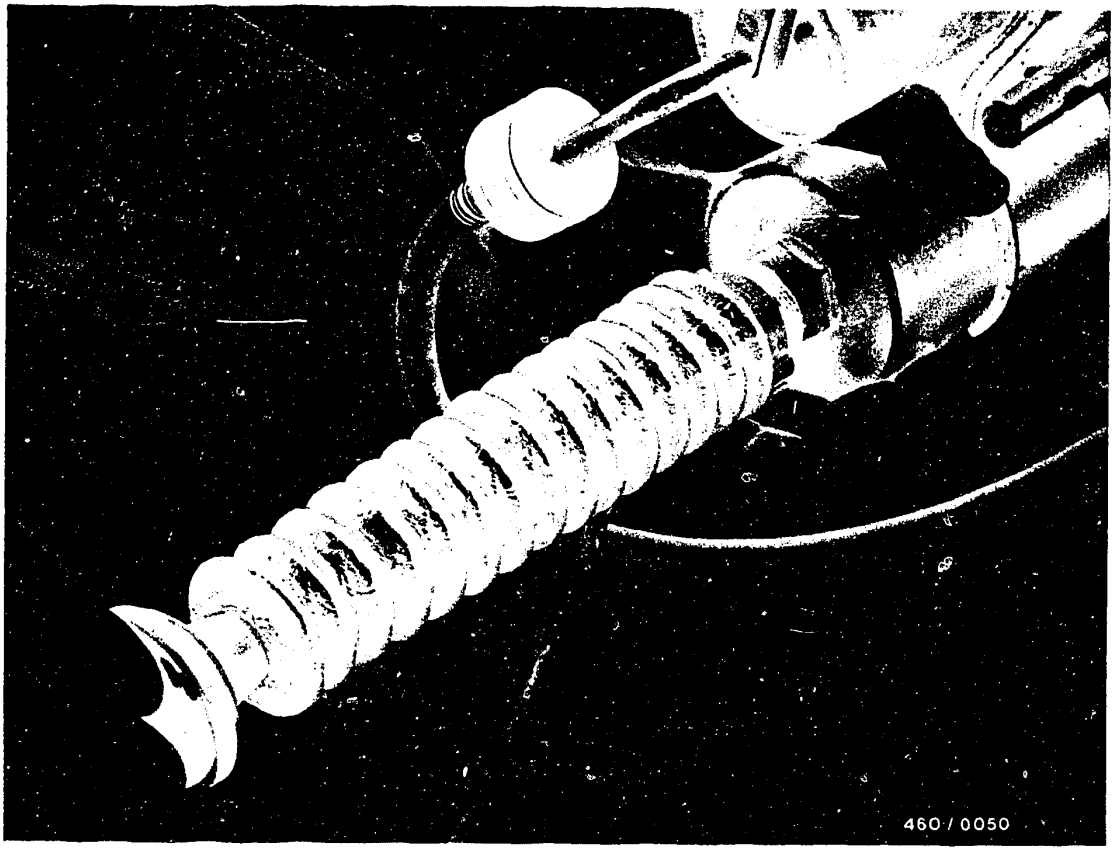
- Accessories box with metering pump 0 681 169 038
- Evaluation unit 0 684 102 050

Insert filter plate into metering pump.



Fasten metering unit on exhaust pipe using suitable clamp.

Introduce sampling probe as far as possible into exhaust pipe and clamp in place.



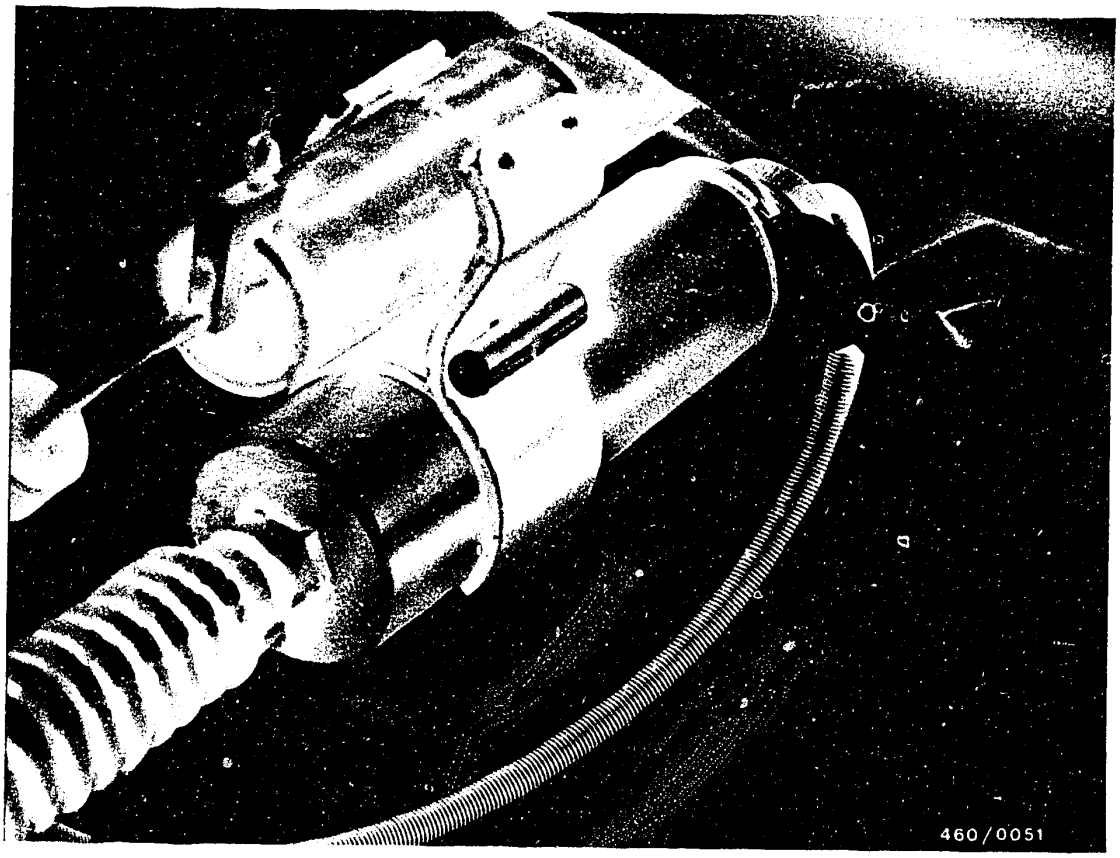
Testing:

Set the metering pump by pushing in the black knob.
Take rubber ball on triggering hose and enter passenger compartment.

Test can be performed on the "rolling road" (chassis dynamometer) or on the road (slope).

The test on the chassis dynamometer is always to be preferred.
Find the gear in which, with the accelerator in the full-load position, a speed of approx. 40 km/h is obtained.

Load the engine so that, with the accelerator in the same position, a speed of approx. 25 km/h is obtained.



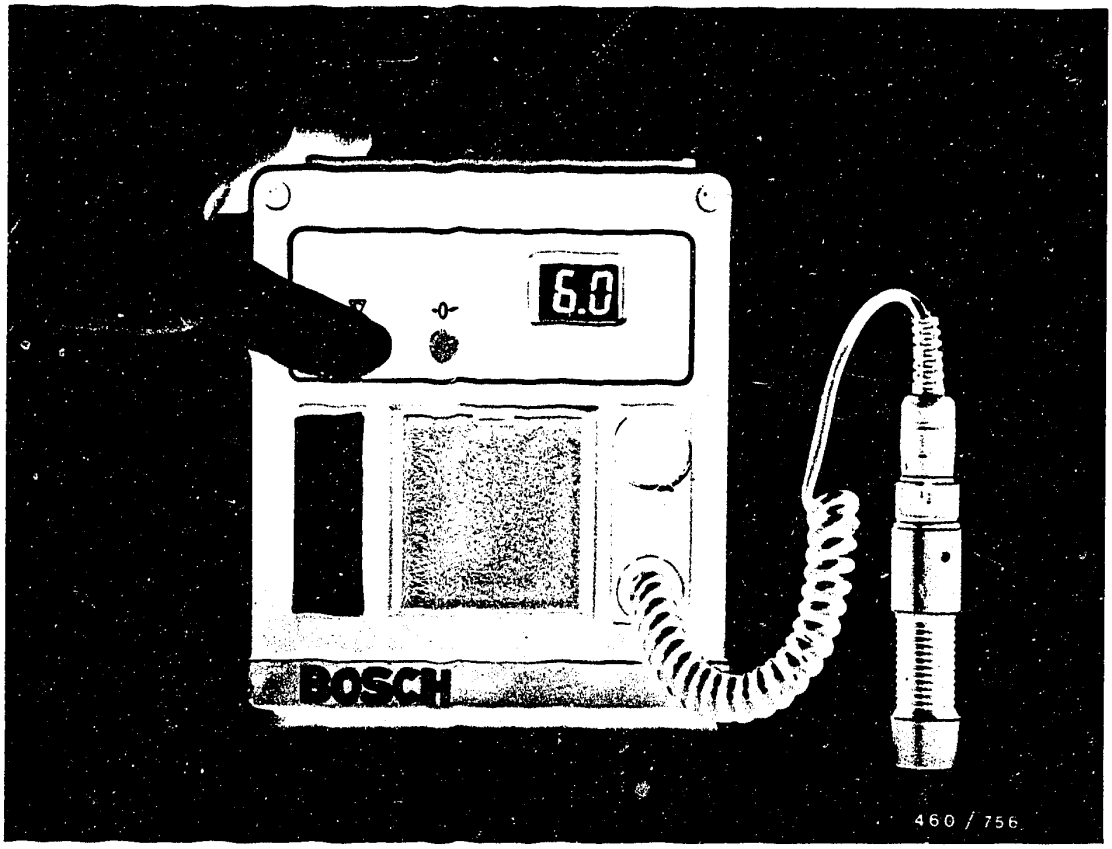
Maintain this load condition for 5 seconds. Then trigger the metering unit by pressing on the rubber ball.

Switch off the engine.

WARNING!

During the following operation, remember that the exhaust pipe has been heated by the running of the engine.

Remove filter plate from metering unit.



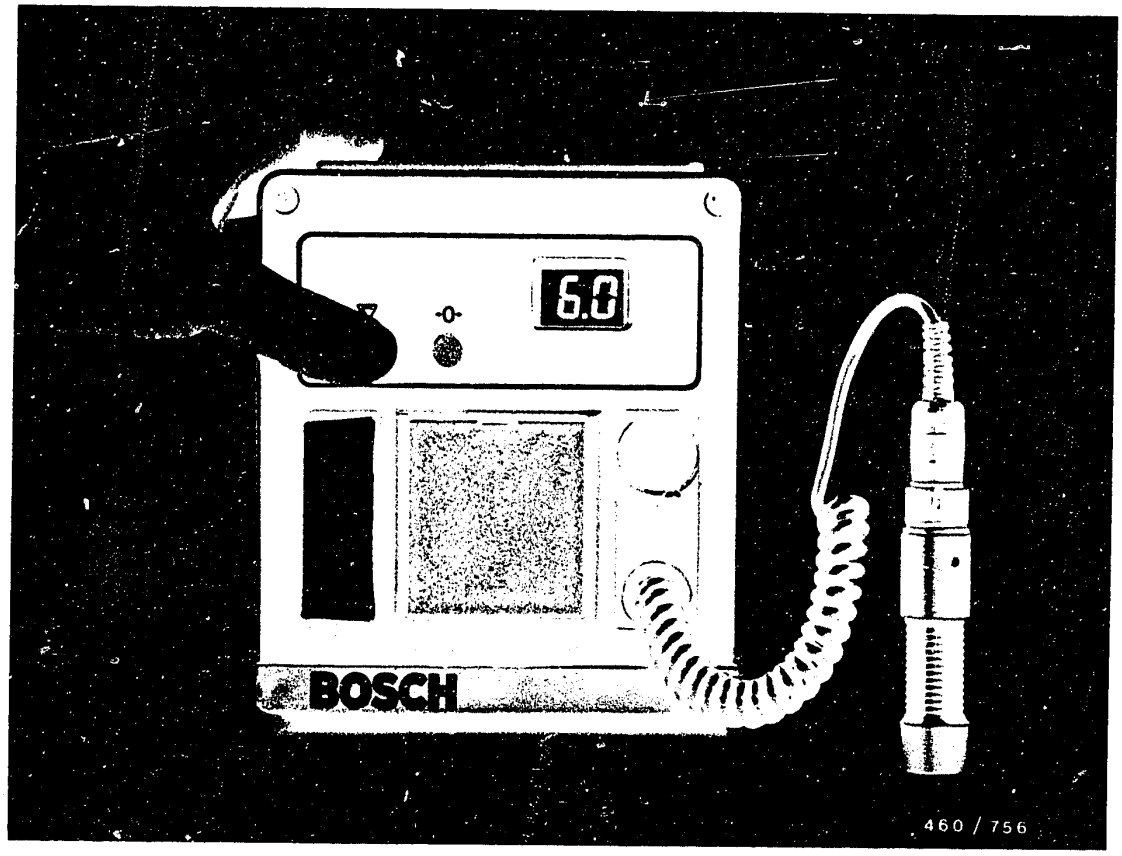
Adjusting the zero point

The zero point adjustment must be performed

- before each series of measurements
- if there are changes in ambient conditions
- whenever the lens of the photoelement adapter has been cleaned.

Firmly press the measuring head of the photoelement adapter onto 5 clean, white filter plates placed one on top of the other.

Press button "0" until reading 0.0 appears.
Release button "0".



Measuring

Place filter plate from metering unit, sooted side up on 3 new filter plates placed one on top of the other.

Press measuring head vertically onto black surface of filter plate.

At the same time press button "C" until the smoke number appears on the display.

Note:
The measuring head must be pressed down firmly both for the zero point adjustment and when measuring (even slight tilting can lead to measurement errors).

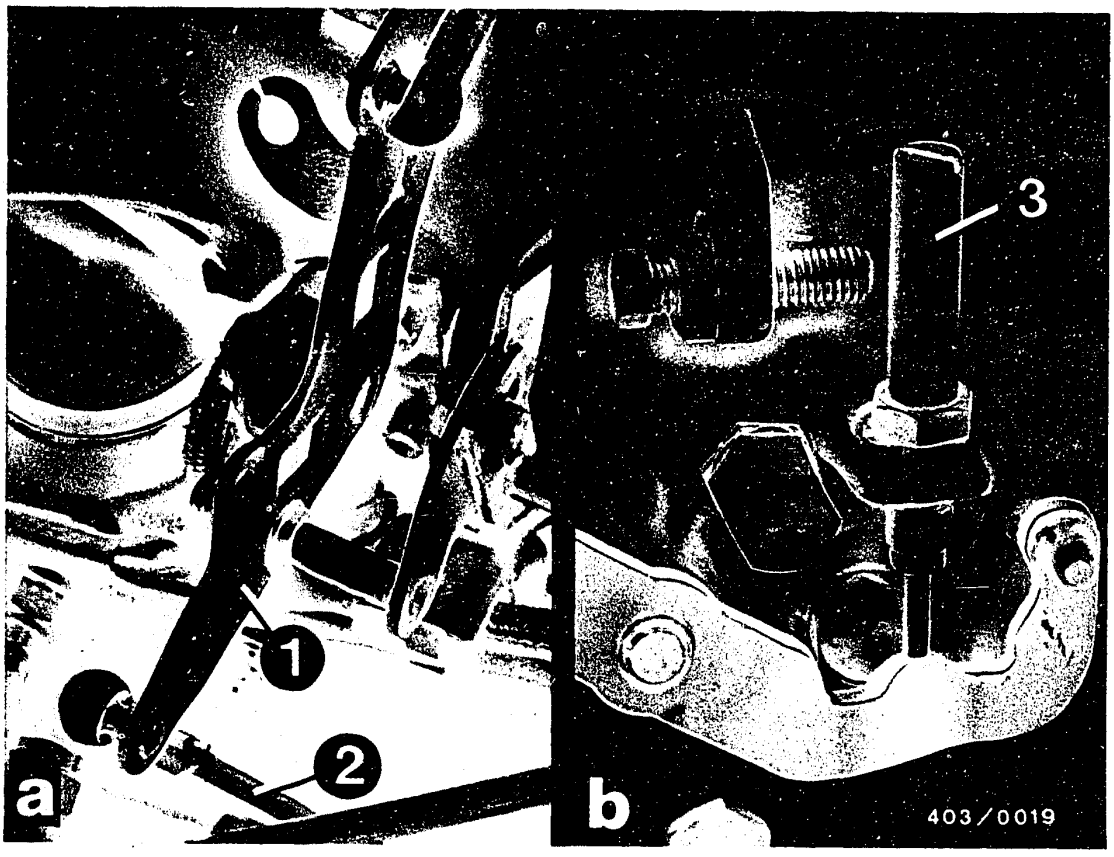
17.2 Check air filter

Remove air filter and subject to a visual examination.

Test criteria for air filter:

- If air filter dusty - knock out.
- If air filter oil-fouled - replaced.
- Remove solid matter in air filter (e.g. leaves).

If in doubt, use new filter element.



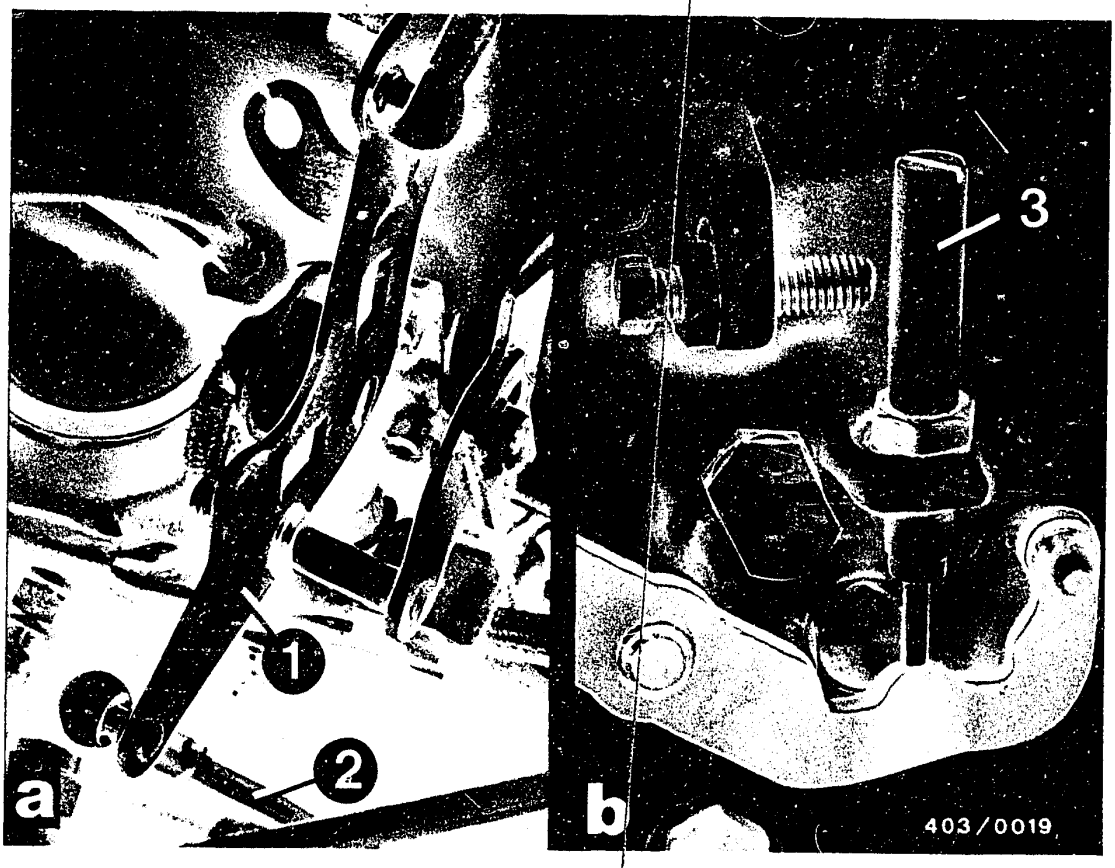
1 = Bell crank
2 = Pressure rod
3 = Adjusting screw

18. ADJUST IDLE SPEED

Connect motortester with adapter cable to diagnostic socket.
Unhook pressure rod (2) from bell crank (1). Check accelerator control linkage for freedom of movement and wear. Start engine.
To adjust the idle speed, the engine must be at normal operating temperature (cooling water temperature + 80°C).

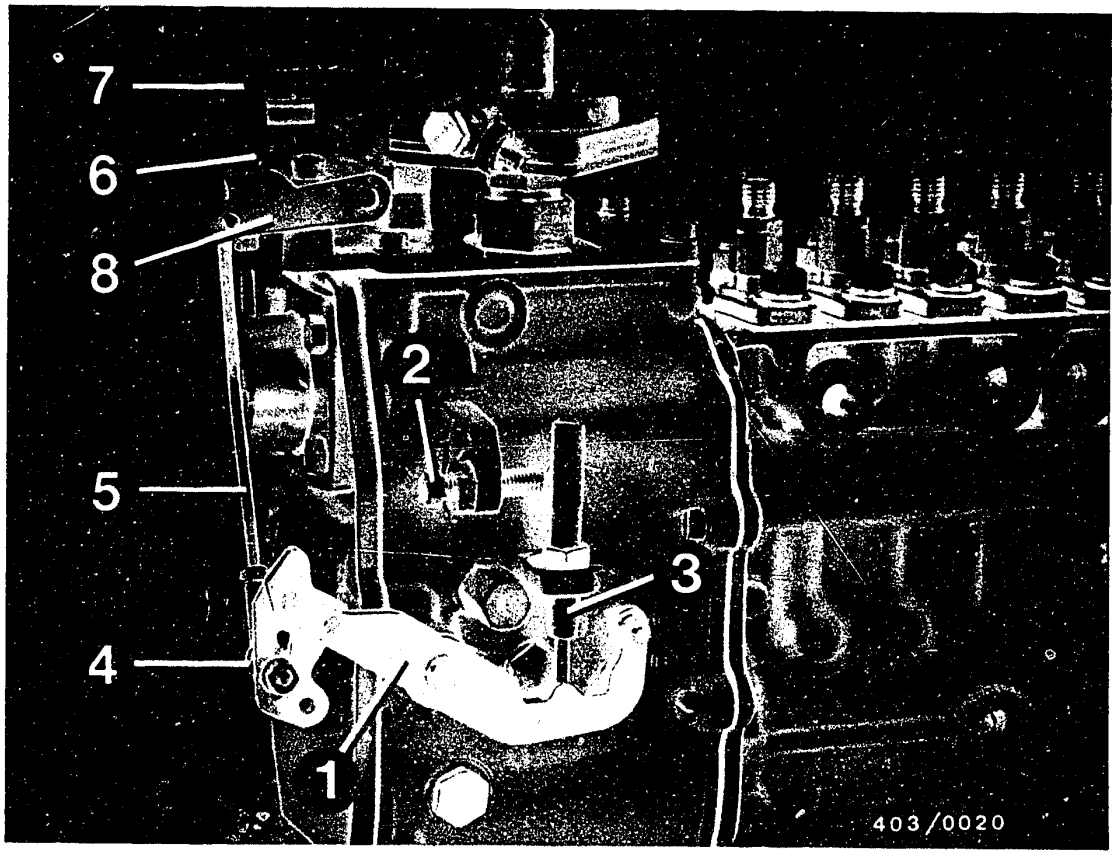
Adjust engine speed at idle adjusting screw (3) to 650...850 min^{-1}.

Turning to the right = increases engine speed
Turning to the left = reduces engine speed



Hook in pressure rod (2) free of tension.

If a correction is necessary, check the accelerator control linkage and adjust, if necessary.
Select drive mode with selector lever; switch on automatic air conditioner.
Turn power steering to full lock; the engine must run evenly.
If the engine stops, the idle speed must be corrected.

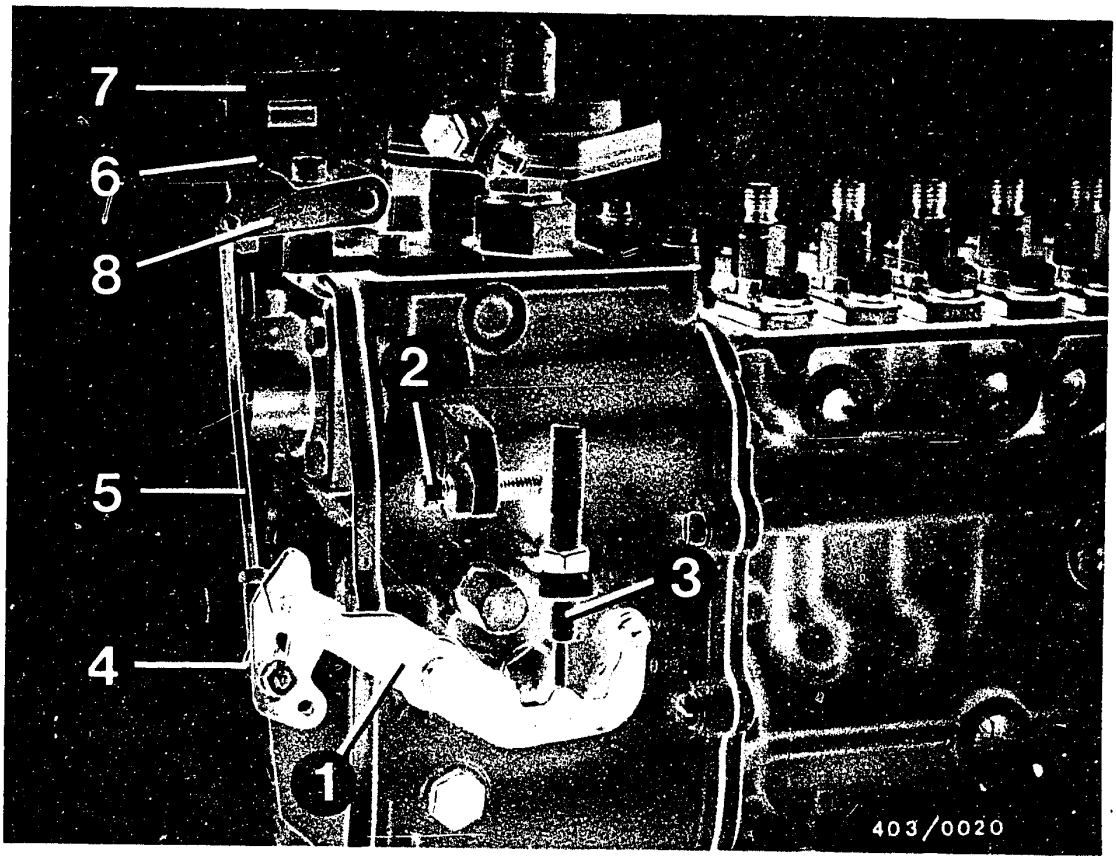


1 = Control lever
2 = Full-load stop
3 = Idle stop
4 = Ball head
5 = Connecting rod
6 = Full-load stop (vacuum-control valve)
7 = Valve
8 = Operating lever for vacuum-control valve

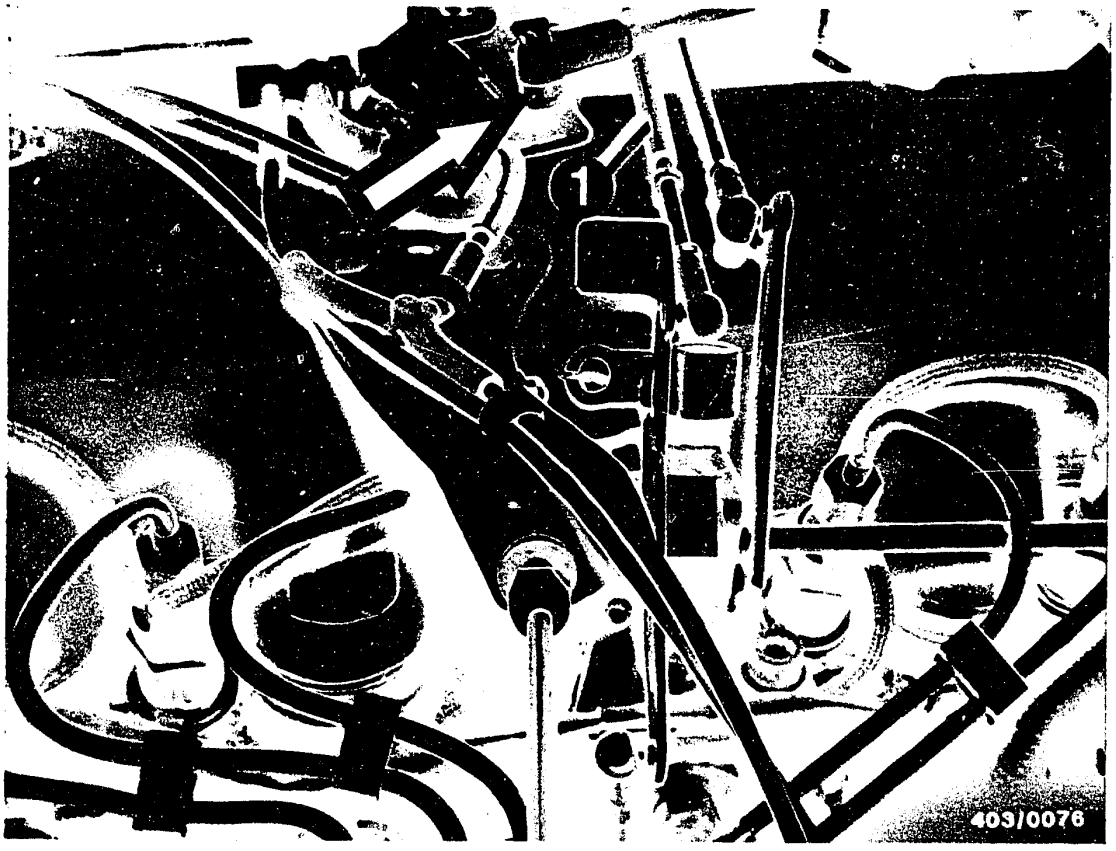
19. ADJUST ACCELERATOR CONTROL LINKAGE (80 model year)

19.1 1980 model year

Check accelerator control linkage for freedom of movement and bending. Unhook all control rods.
Check whether the control lever (1) of the injection pump is up against the idle stop (3).
Check whether the connecting rod (5) is correctly adjusted. To do this, press the control lever (1) onto the full-load stop (2). The operating lever (8) must have max. 0.5 mm play before the full-load stop (6).

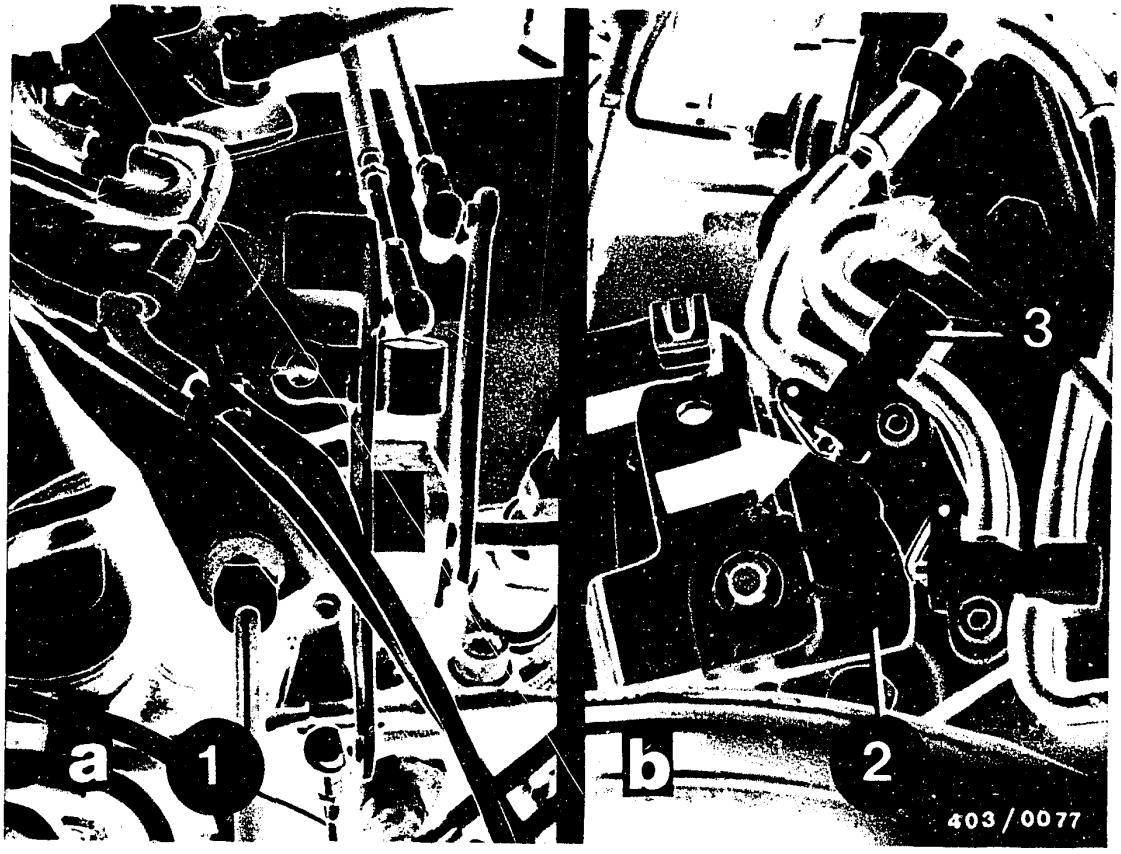


If necessary, adjust connecting rod (5) with the adjustable ball head (4).
The connecting rod (5) must be adjusted to 122 mm + 1 mm, measured from center of ball socket to center of linkage.



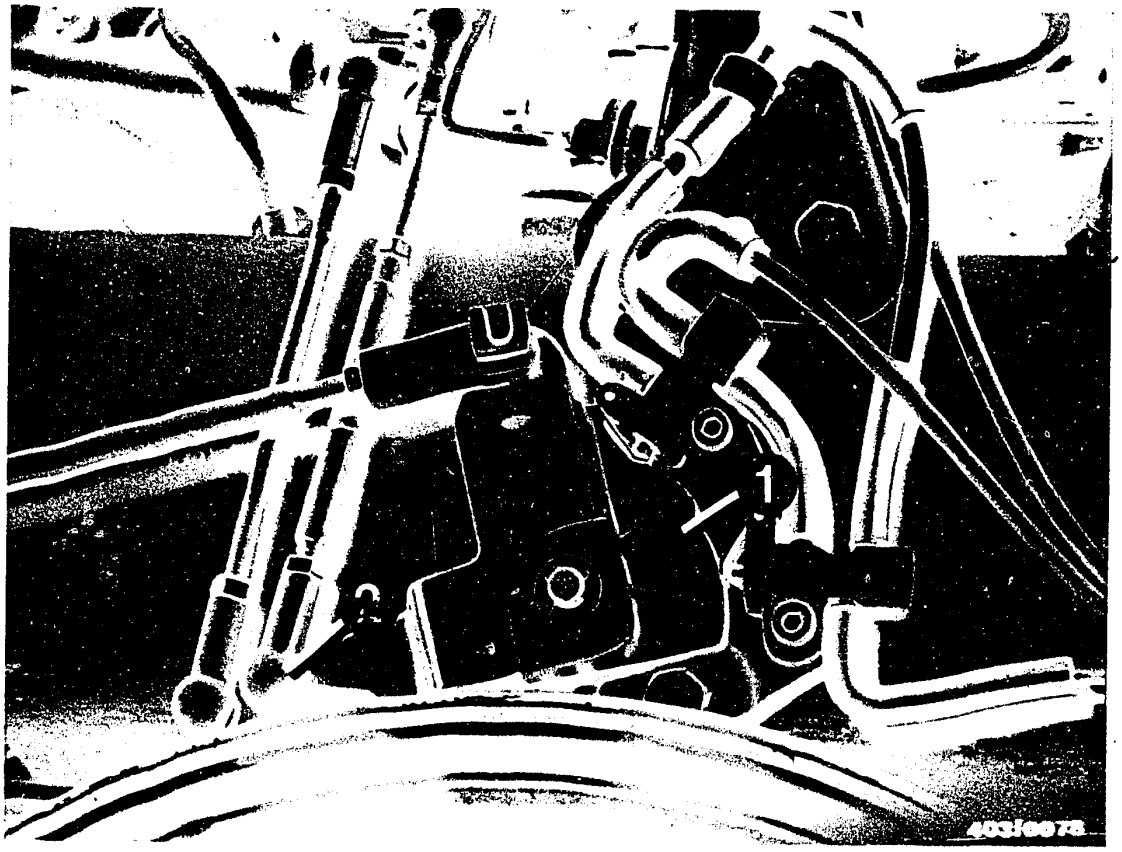
Plug adjusting sleeve (DB part) onto the locating pin (arrow) of the holder.

While fully extended, adjust free-travel rod (1) to 154 mm (measured from center of ball head to center of ball head) and hook in.



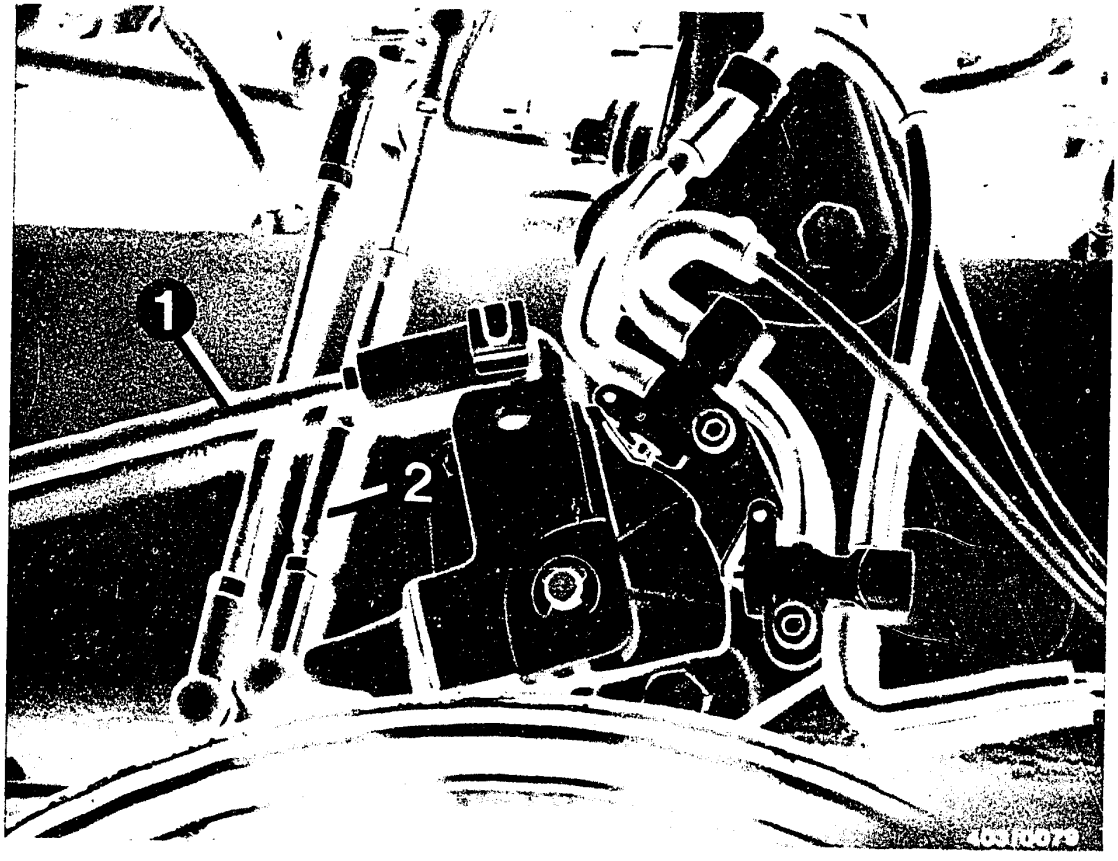
Adjust pressure rod (1) so that there is max. 0.5 mm play between trip-cam elevation of reverse-transfer lever (2) and the strap (arrow) of the change-over valve (3).

For this, the control lever on the injection pump must be up against the idle stop.



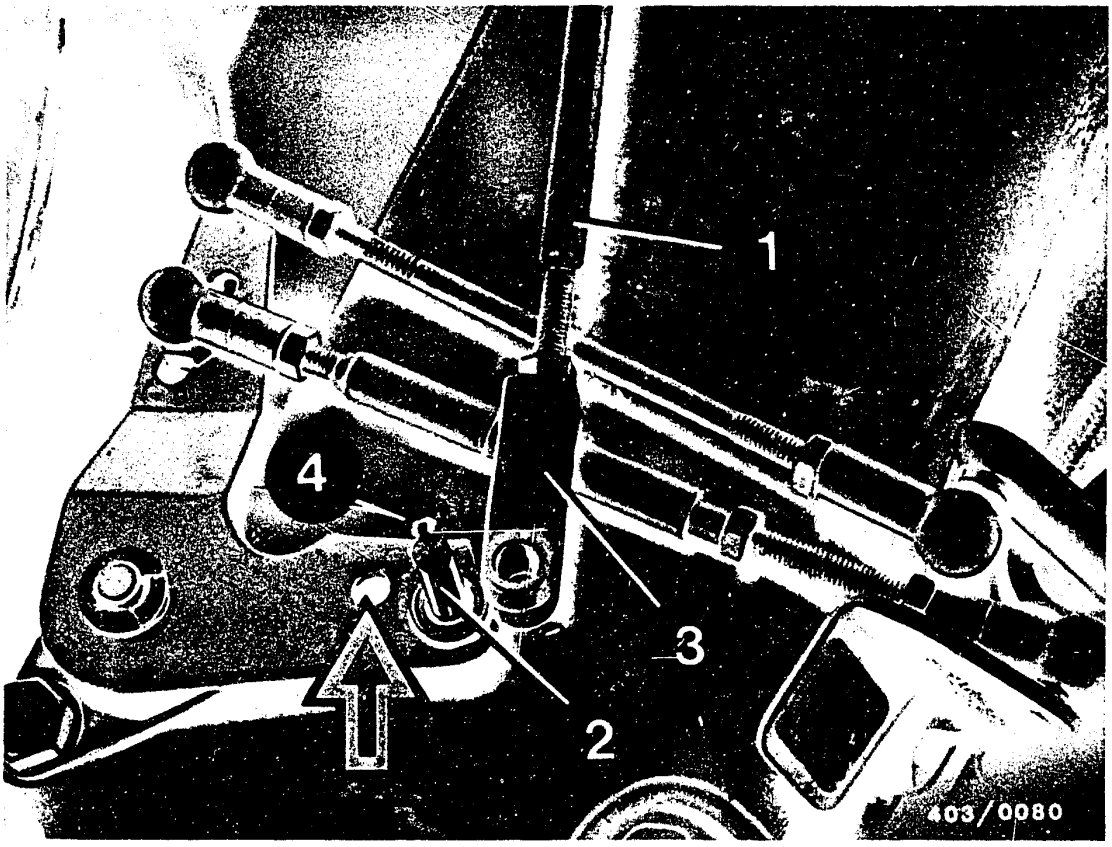
Adjusting the full-load stop

Press the reverse-transfer lever (1) in the full-load direction. Adjust ball head (2) in slot of reverse-transfer lever so that the reverse-transfer lever is up against the adjusting sleeve (DB part) and the control lever on the injection pump is up against the full-load stop.



Adjusting the control pressure rod (1).

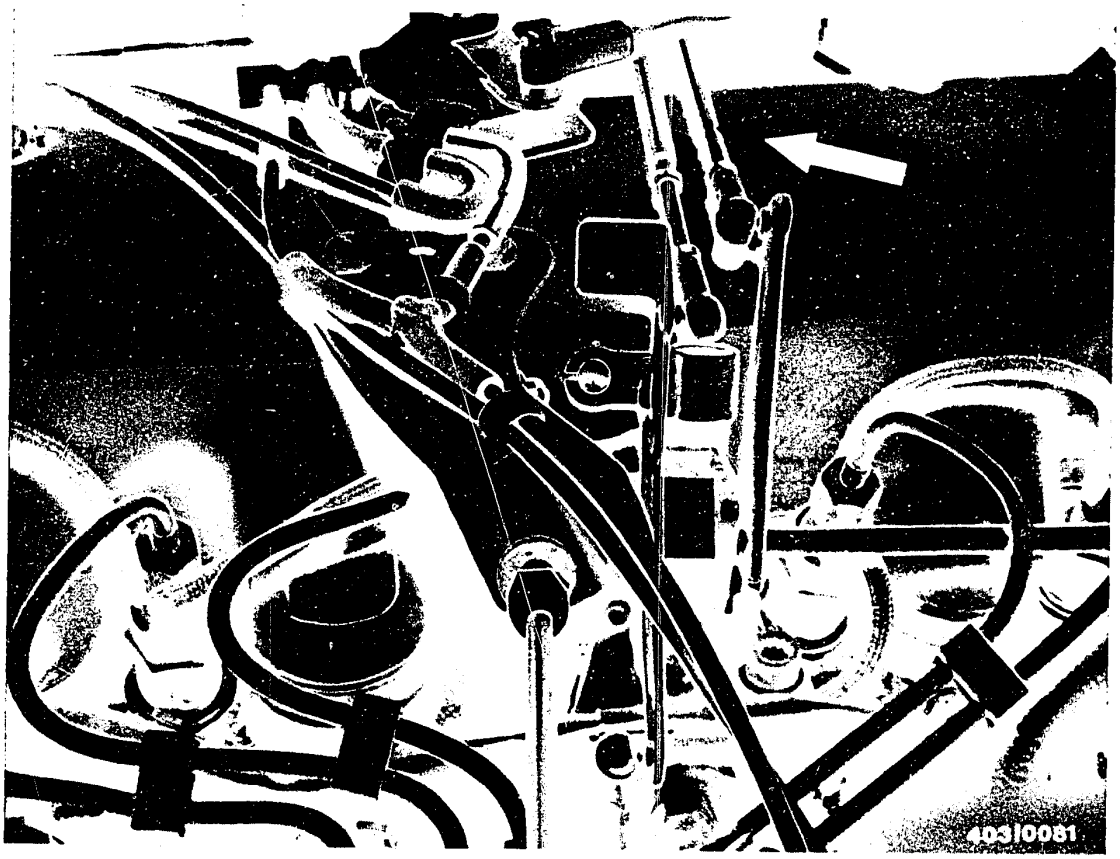
Bring control lever of injection pump up against idle stop (free-travel rod (2) must be extended). Carefully press control pressure rod onto idle stop on transmission.



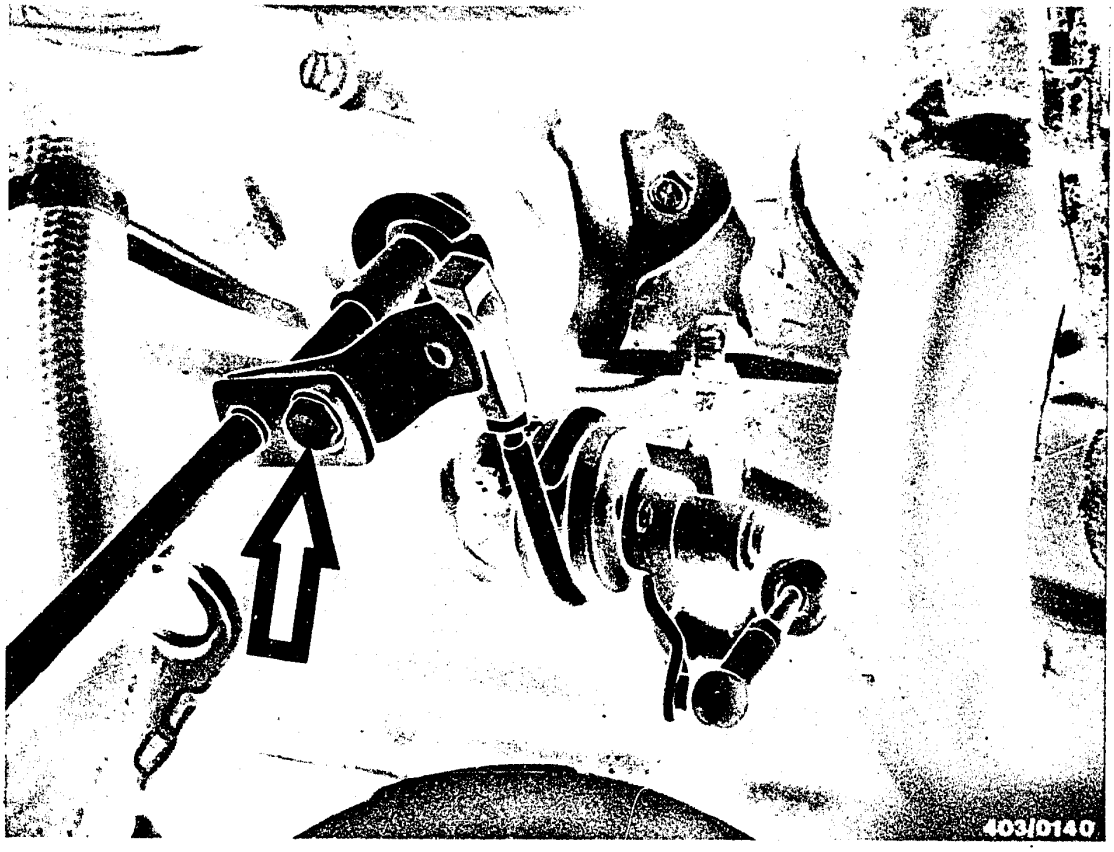
Hold control pressure rod (1) over the test bore (arrow) next to the pin (2).
Change end-piece (3) in length until the bore in the end-piece aligns with the test bore. Hook in control pressure rod (1). Tighten lock nut and secure with locking device.

Note:
When hooking in the end-piece, the trademark should point upward.

Remove the adjusting sleeve (4).

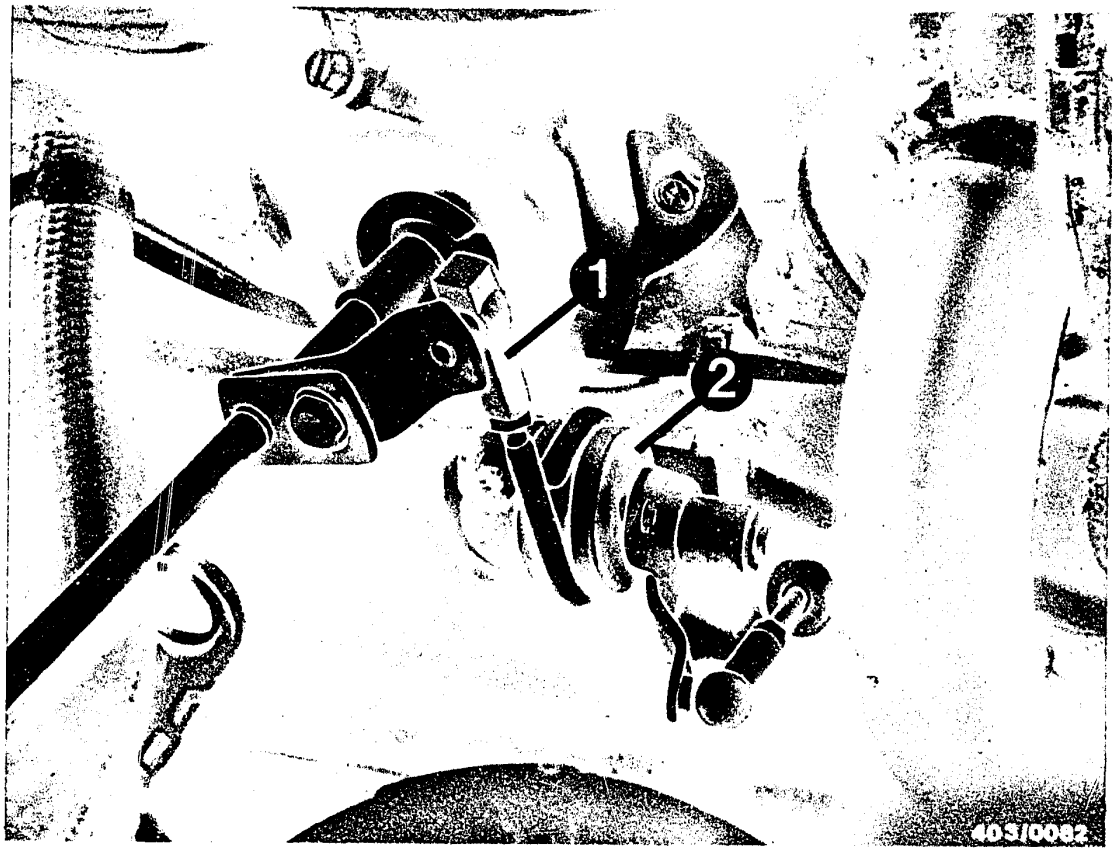


Adjust tie rod (arrow) to 137 mm (measured from center of ball head to center of ball head) and hook in.

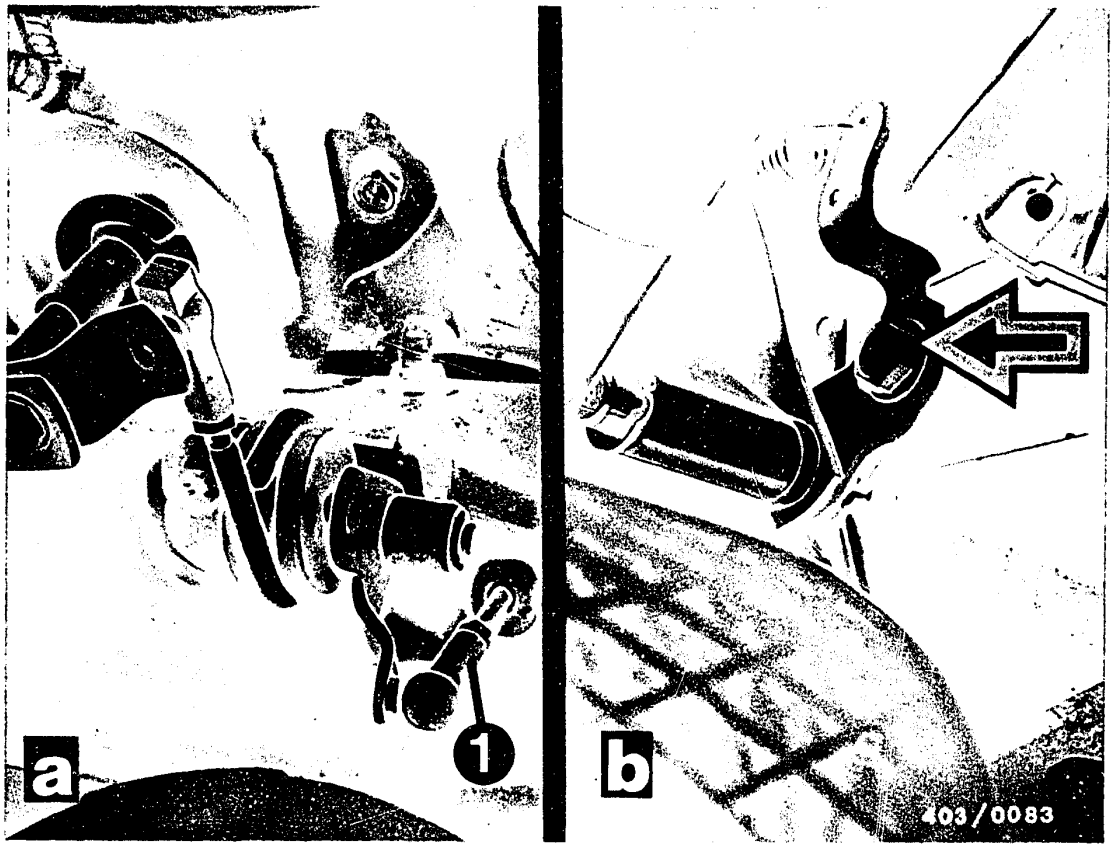


Checking the full-load stop.

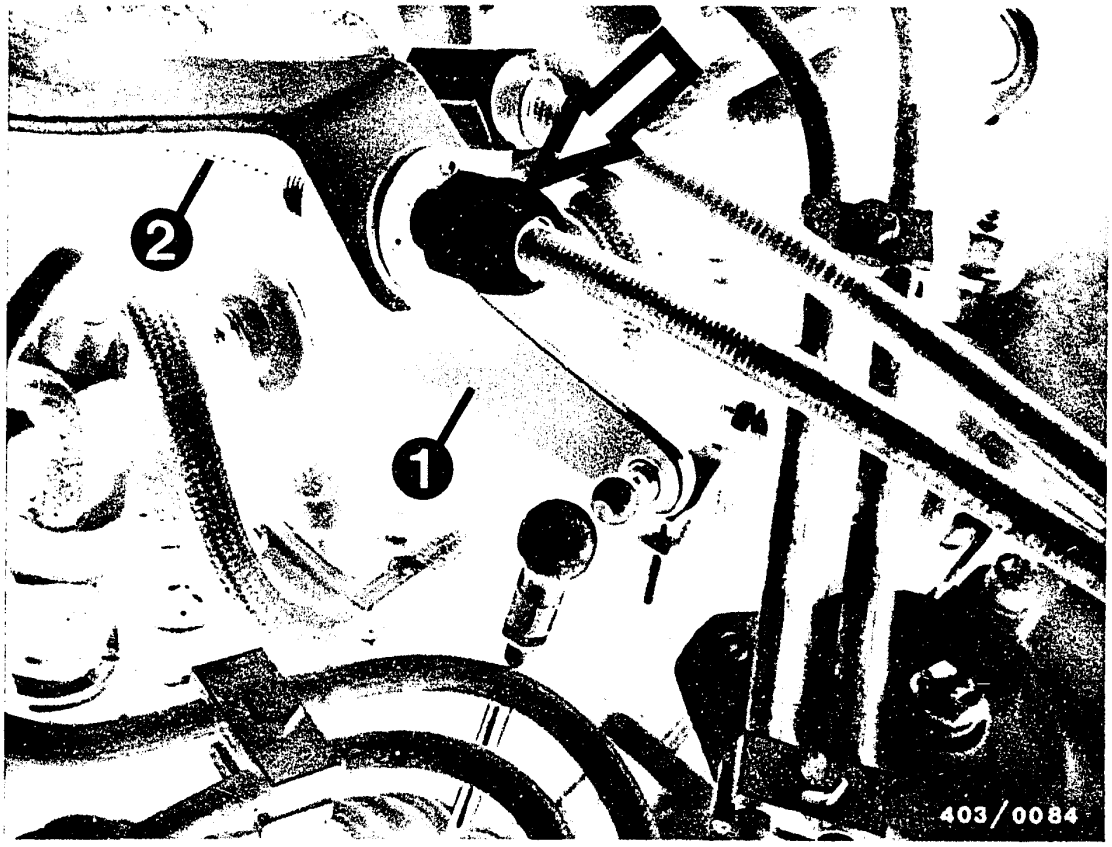
With the engine switched off, from inside the vehicle, press the accelerator until it comes up against the kickdown switch. The accelerator and the control lever on the injection pump must be up against the full-load stop. If a correction is necessary, loosen adjusting screw (arrow), and adjust accelerator control linkage so that the control lever is up against the full-load stop.



If the full-load stop is not reached, adjust tie rod (1) between longitudinal control shaft and accelerator to 68 mm, measured from center of ball socket to center of damping ring (2).



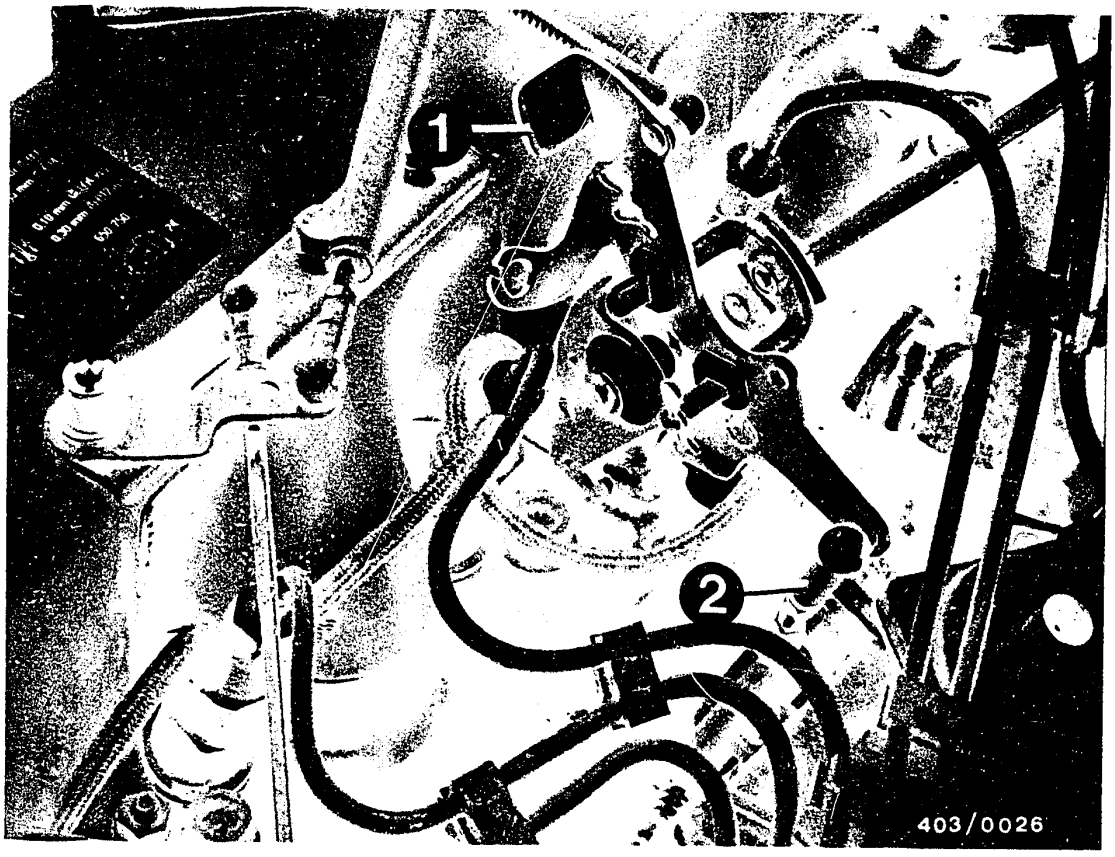
If, with the previous adjusting operations, the full-load stop/idle stop is not reached, adjust connecting rod (1) between reverse-transfer lever in engine compartment and accelerator to 122 mm (measured from center of ball socket to center of ball socket).
Make necessary correction at control lever (passenger compartment).
Loosen fastening screw (picture b - arrow).
Pull accelerator slightly upward and tighten fastening screw.



Adjusting the cruise control

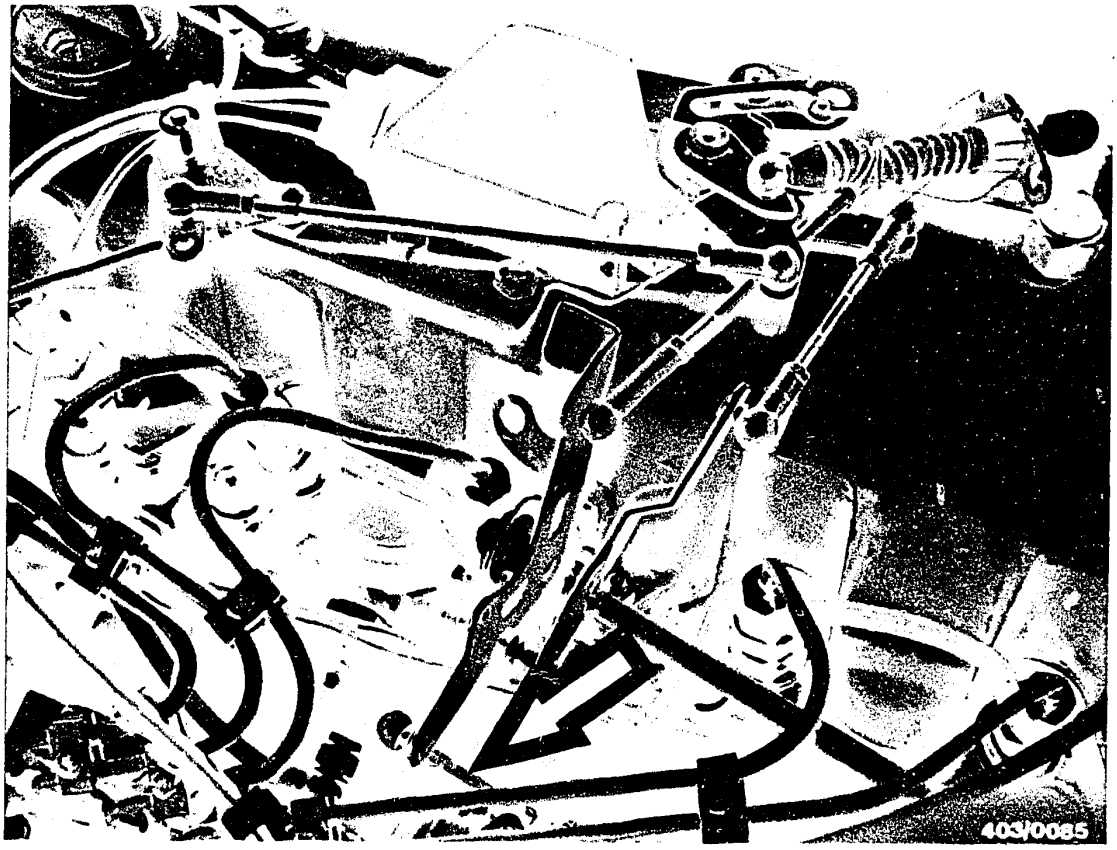
Press stop lever as far as stop.
The cable should be up against the control lever (1) free of tension.

Correction:
Adjust cable with adjusting screw (arrow). Release stop lever. In this position, the cable (2) must have play.



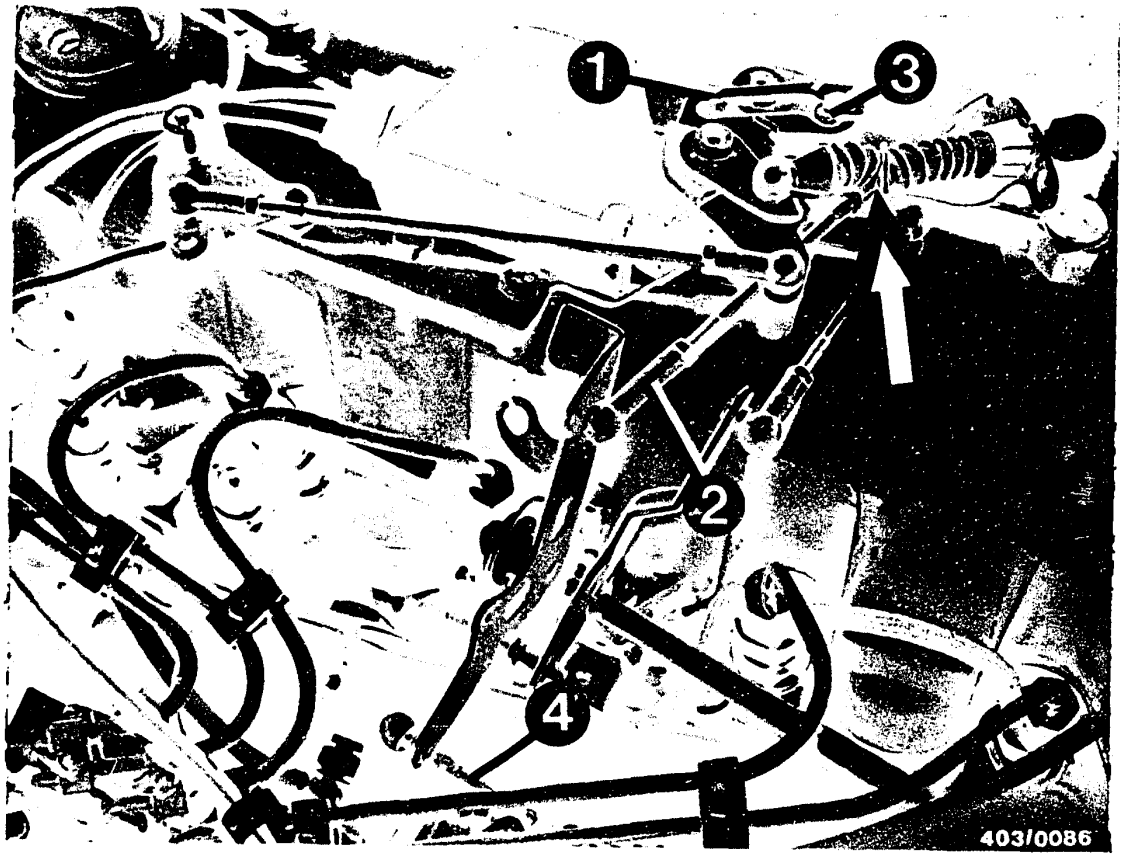
Checking the operation of the emergency-stop button

Operate engine at idle speed.
Press emergency-stop button (1).
The engine must stop.
If a correction is necessary, correct pressure rod (2).



19.2 Adjust accelerator control linkage (81/82/83/84 model years)

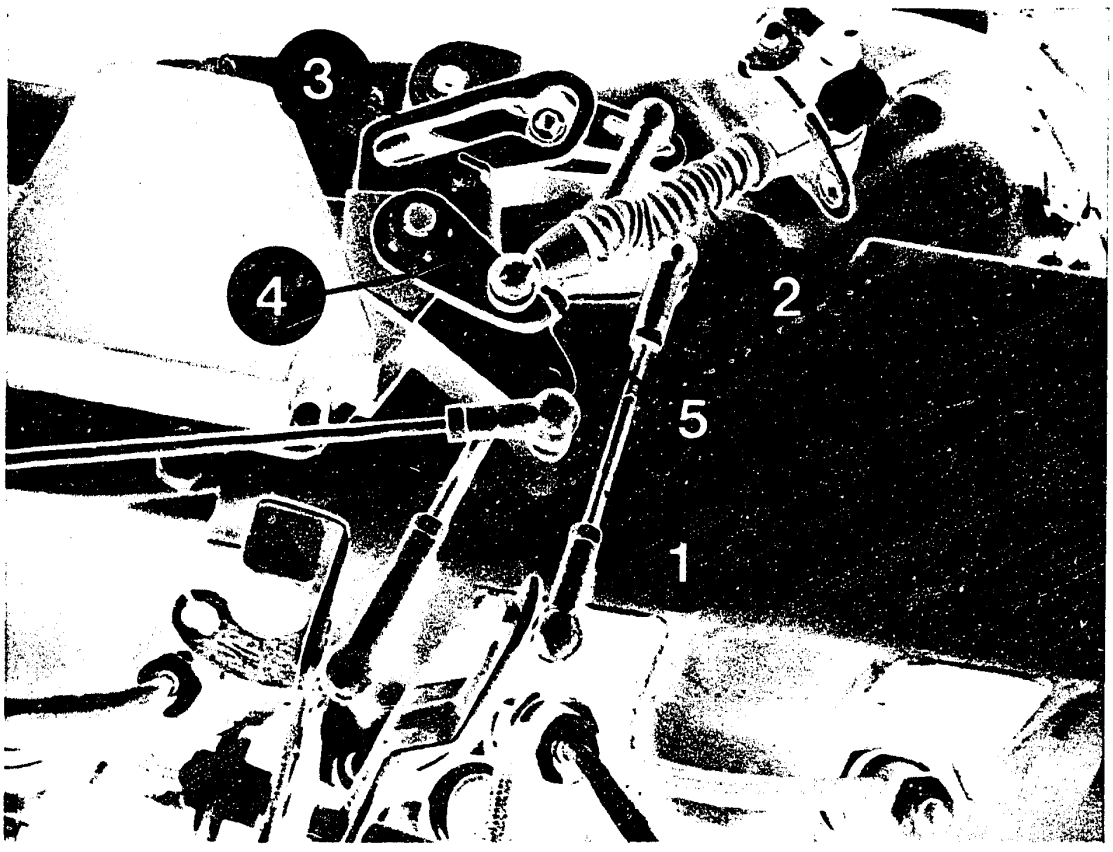
Adjust pressure rod (arrow) to 184 mm (measured from center of ball socket to center of ball socket) and hook in.



Adjusting the reverse-transfer lever (1)

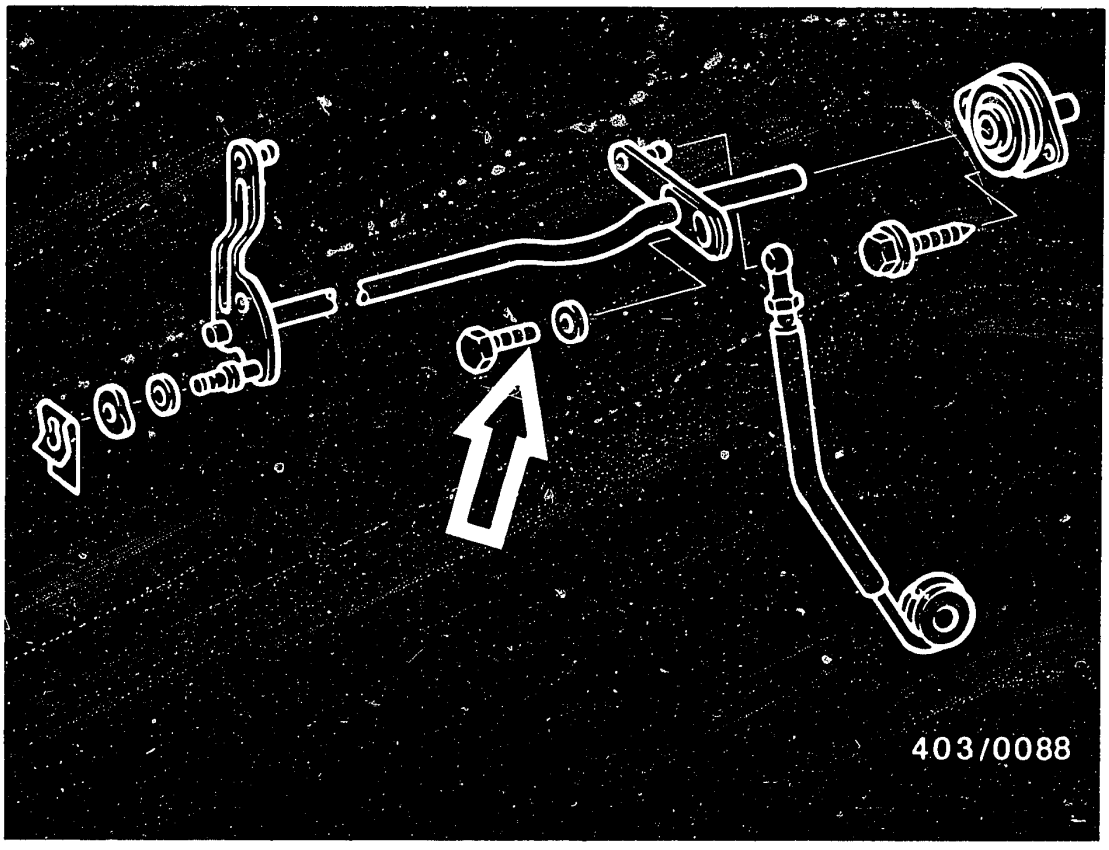
Idle position: Adjust pressure rod (2) so that the roller (3) in the reverse-transfer lever (1) is up against the end stop free of tension.

Full-load position: Press reverse-transfer lever (1) to full load. The roller (3) must have approx. 1 mm gap in the reverse-transfer lever.
Make correction at the adjustable ball head (arrow).
Note:
If the ball head is adjusted, re-adjust the pressure rod (4).
The control lever on the injection pump must be up against the full-load stop in the full-load position.



Adjust tie rod (1) to 100 mm, measured from center of ball head to center of ball head, and hook in.

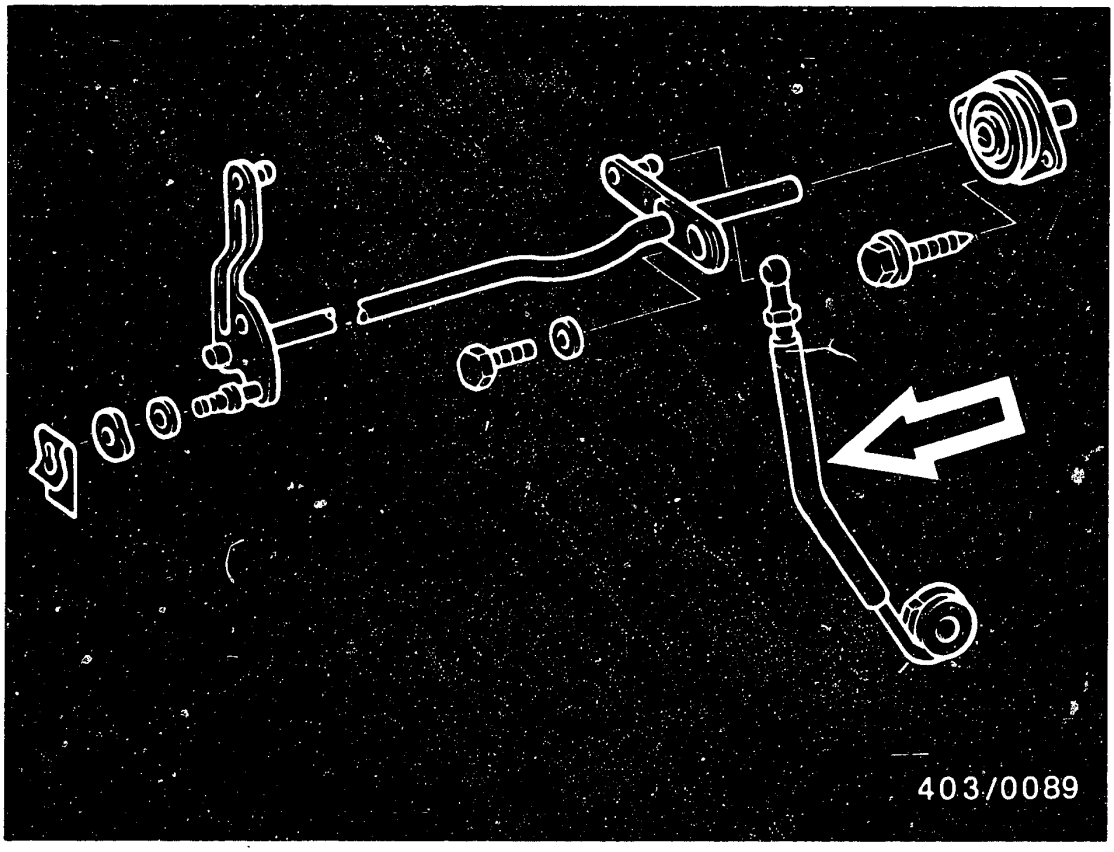
Adjust cable (2). The reverse-transfer lever (3) must be up against the idle stop and the drag lever (4) must be up against the stop (5). Pull cable (2) to detectable idle stop on transmission, and adjust to tension-free length and hook in.



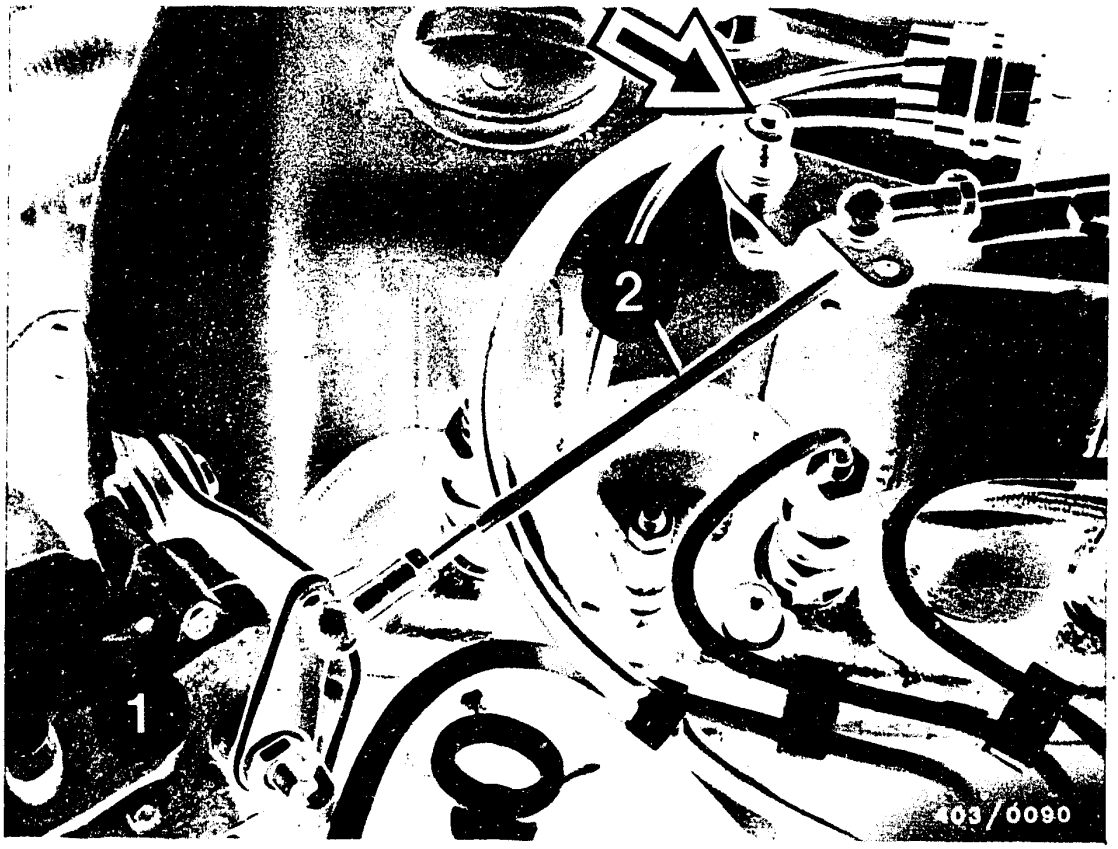
Checking the full-load stop

With the engine switched off, from inside the passenger compartment, press down the accelerator until it comes up against the kickdown switch. The control lever on the injection pump must be up against the full-load stop.

Correction: Loosen adjusting screw (arrow). Adjust control linkage so that the control lever is up against the full-load stop.

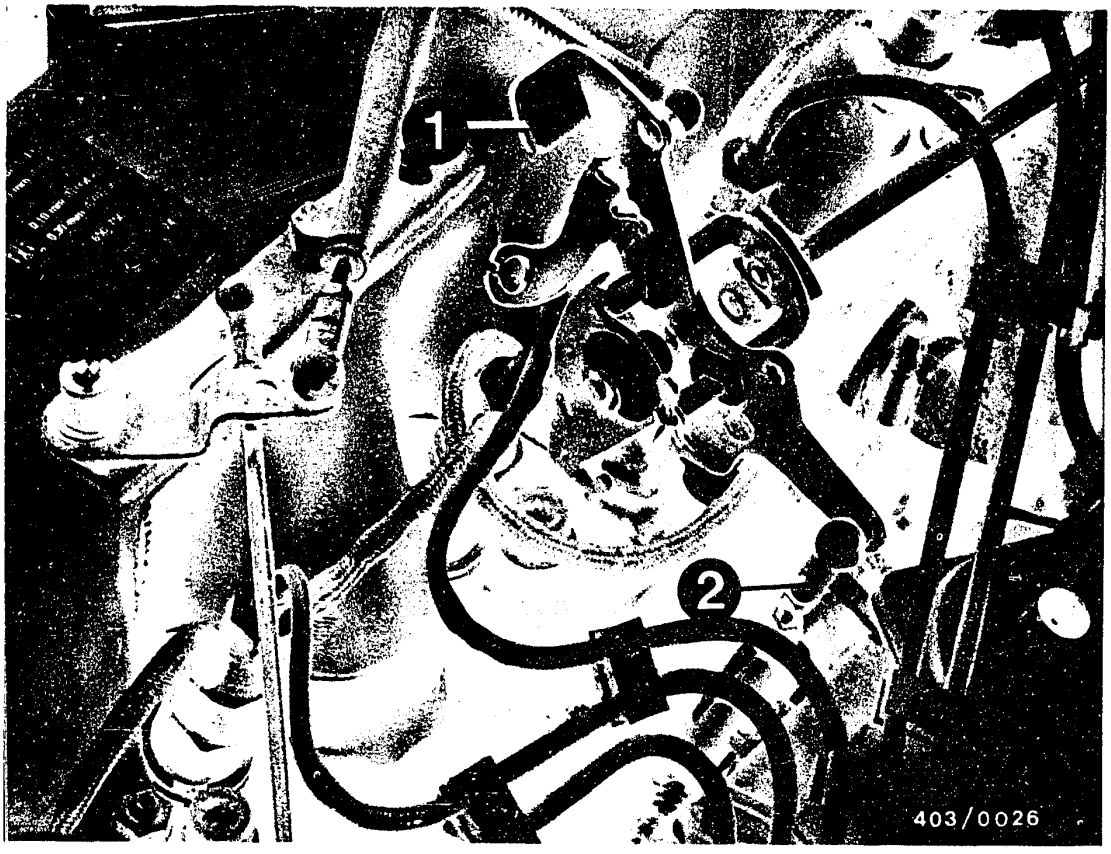


If, with the previous adjustment operations, the full-load stop/idle stop is not reached, adjust the pressure rod (arrow) between the longitudinal control shaft and the accelerator to 222 mm, measured from center of ball socket to center of damping ring.



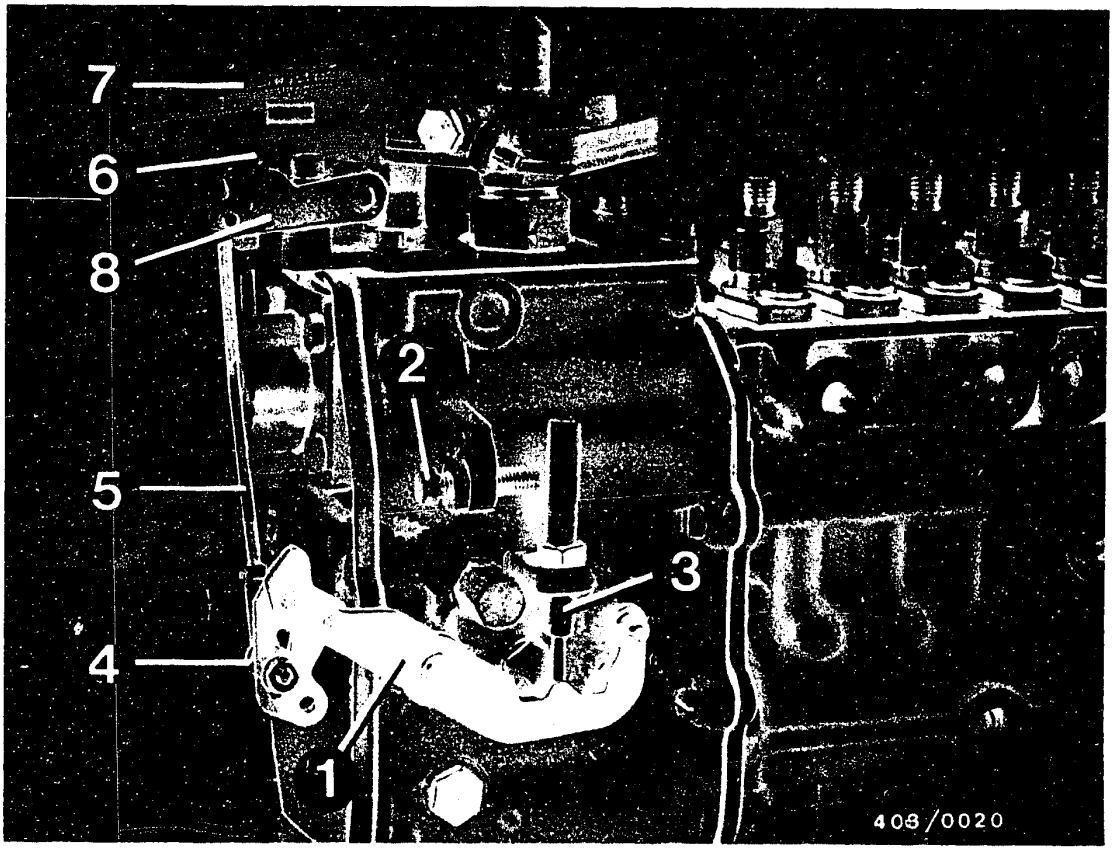
Adjusting the cruise control

Check whether the actuator (1) is up against the idle stop of the cruise control.
To do this, unhook connecting rod (2) and press lever of actuator (1) in a clockwise direction onto the idle stop.
When hooking in the connecting rod (2), make sure that the lever of the actuator is pressed approx. 1 mm away from the idle stop.
If necessary, adjust connecting rod.



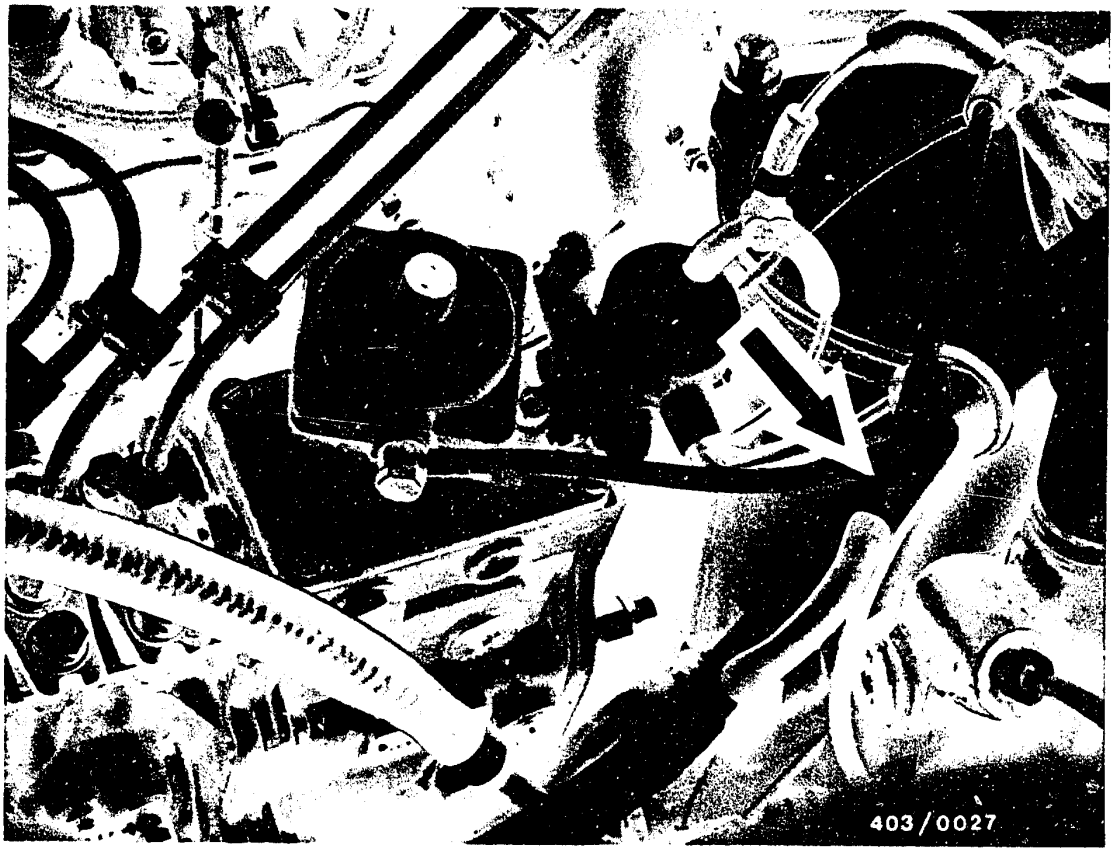
Checking the operation of the emergency-stop button

Operate engine at idle speed.
Press emergency-stop button (1).
The engine must stop.
If a correction is necessary, correct pressure rod (2).



20. ADJUST VACUUM-CONTROL VALVE

If the vacuum-control valve or the fuel-injection pump is replaced, the vacuum-control valve must be adjusted at the adjustable ball head (4). Press the control lever (1) to full load so that it is up against the stop (2).
Loosen the ball head (4) and slide in its slot so that there is approx. 0.5 mm play between lever (8) and stop (6).
Tighten ball head (4); then check adjustment once again.

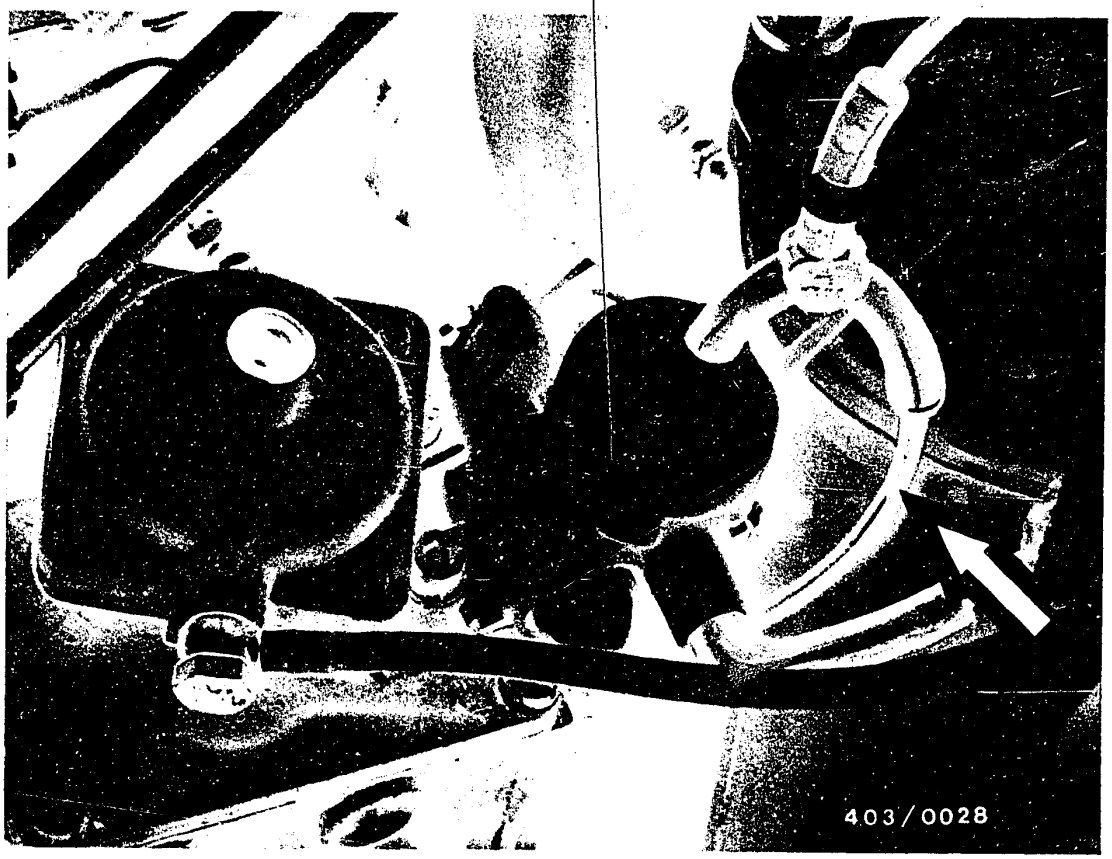


Checking the vacuum system

Bring ignition key on steering lock to position 2.
Pull brown line (arrow) out of connection piece and connect "hand vacuum pump" (Mityvac) with vacuum line to the brown line.
By means of the hand vacuum pump, evacuate the line system to 400 mbar vacuum.
If the pressure gauge shows a pressure rise, the valve for the key-operated starting system on the ignition lock is leaking. Replace valve for key-operated starting system on steering lock.

Caution:
Before replacing the valve of the key-operated starting system and the vacuum unit of the fuel-injection pump, check the hose lines and their connection piece.

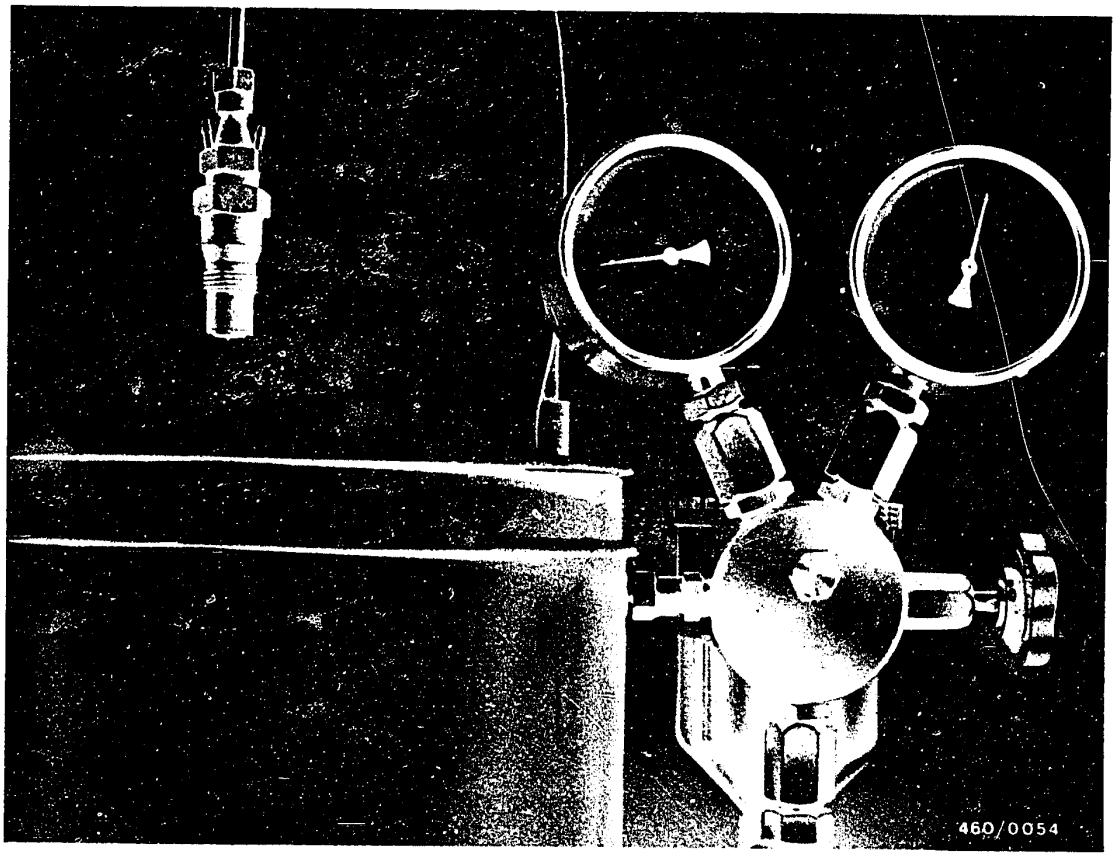
Turn back ignition key on steering lock to position "1" or "0".
Evacuate system with hand vacuum pump to 400 mbar vacuum.
If the pressure gauge shows a pressure rise, the vacuum unit or the valve may be leaking.



Disconnect control line (arrow) with connection piece from the vacuum unit of the injection pump. Connect vacuum line from hand vacuum pump to the vacuum unit and evacuate to 400 mbar vacuum.
If the pressure gauge shows a pressure rise (max. 6 mbar/min at 400 mbar vacuum), the vacuum unit of the injection pump is leaking.

Replace vacuum unit of injection pump.

If there is no change in the reading on the pressure gauge, the vacuum unit of the injection pump is leak-tight and the cause of the leak is the valve for the key-operated starting system. Replace valve for key-operated starting system.



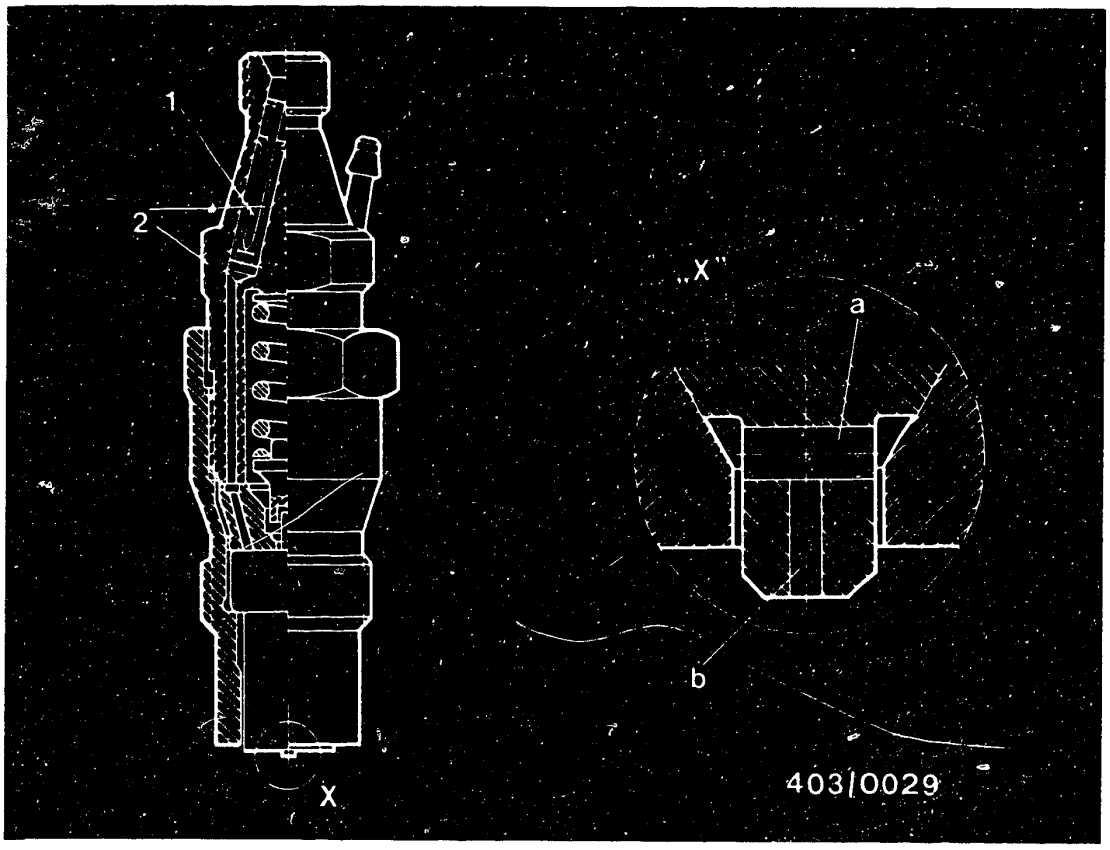
21. TEST INJECTION NOZZLES

Remove injection nozzles.

Testing is performed with nozzle tester EFEP 60 H
0 681 200 502.

Mount injection nozzle with nozzle holder on nozzle tester.

Caution:
When testing injection nozzles, make sure that the fuel spray does not strike your hands since, due to the high pressure, the fuel penetrates into the skin and may cause blood poisoning.



The injection nozzle is a hole-type pintle nozzle. It differs from the previous DN 0 SD 220 by a transverse bore (a) and a longitudinal bore (b) in the pintle as well as by a narrower throttling gap. Furthermore, the top part (2) of the injection nozzle is equipped with a maintenance-free edge-type filter (1).

21.1 Chatter test - evaluation of spray pattern

General:
When evaluating nozzles, a difference must be made between new and used nozzles.
Perform chatter test and spray test one after the other. Switch off the pressure gauge of the nozzle tester by closing the shutoff valve.
This is necessary in order to protect the pressure gauge.

New nozzles:
The chatter test allows an audible examination of the freedom of movement of the nozzle needle in the nozzle body. If, despite cleaning, a nozzles does not chatter, it must be replaced by a new nozzle. The shape of the spray is of no importance for the chatter test. A regulation spray pattern is generally only obtained with new nozzles.

Used nozzles:
The chatter behavior of the nozzle deteriorates due to wear in the area of the seat. When the lever is moved rapidly, the nozzle must chatter audibly and/or squirt a well atomized spray. In the case of used nozzles, the spray pattern may differ from the ideal shape of the new nozzle. An impairment of the operating performance of the engine cannot always be derived from this.
However, the spray pattern of such nozzles can be noticeably improved by appropriate cleaning.

21.2 Leak test

Pressure gauge on.

Slowly press lever downward and hold pressure approx. 20 bar below opening pressure for 10 seconds. No drop may fall from the nozzle.

21.3 Check injection pressure

Switch on pressure gauge.

Slowly press lever downward. When nozzles begins to squirt, read off injection pressure.

If the test specification is not obtained, the nozzle-opening pressure must be corrected by means of shims behind the pressure spring in the nozzle holder.

Test specification for new nozzles: 135 + 8 bar

Test specification for used nozzles: min. 120 bar

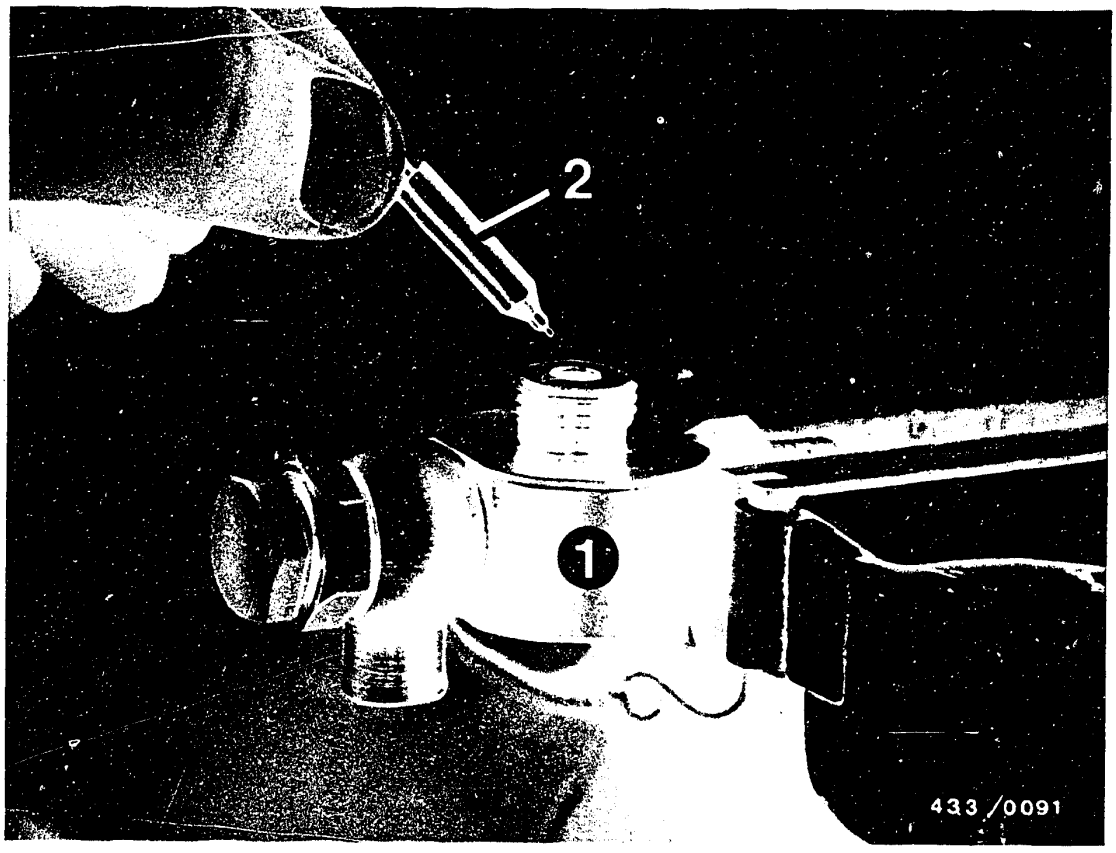
Note: When assembling the nozzle, pay attention to the tightening torque 70...90 Nm. If the tightening torque is exceeded, the nozzle needle may stick.

21.4 Chatter test:

Due to its special structural features, this nozzle chatters very softly. A chatter test is possibly only at between 1...2 downward movements of the hand lever per second.
When the test speed is raised, the chattering stops. The calibrating oil then escapes from the nozzle with a hissing noise. The nozzle chatters with a high-pitched tone only when the hand lever is moved with rapid jerks (approx. 4...6 downward movements per second).

21.5 Spray pattern: (applies only to new nozzles)

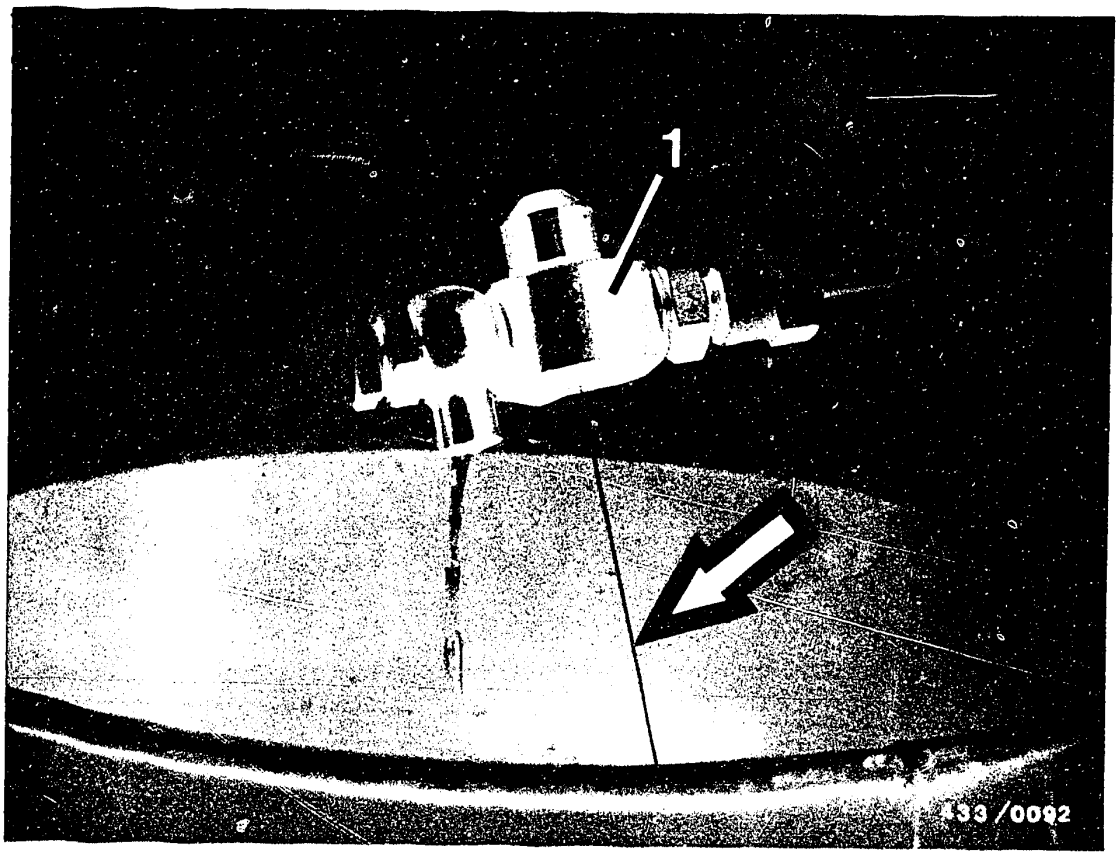
An evaluation of the spray pattern is possible only with rapid movement of the hand lever (4...6 downward movements per second). The spray must be concentrated and well atomized.



1 = DN test accessory 1 688 130 153 (overflow valve)
2 = Hole-type pintle nozzle (object under test)

21.6 Testing the transverse and longitudinal bores in the nozzle needle

Needle tester 1 688 130 153 is required for this additional test.



Test sequence

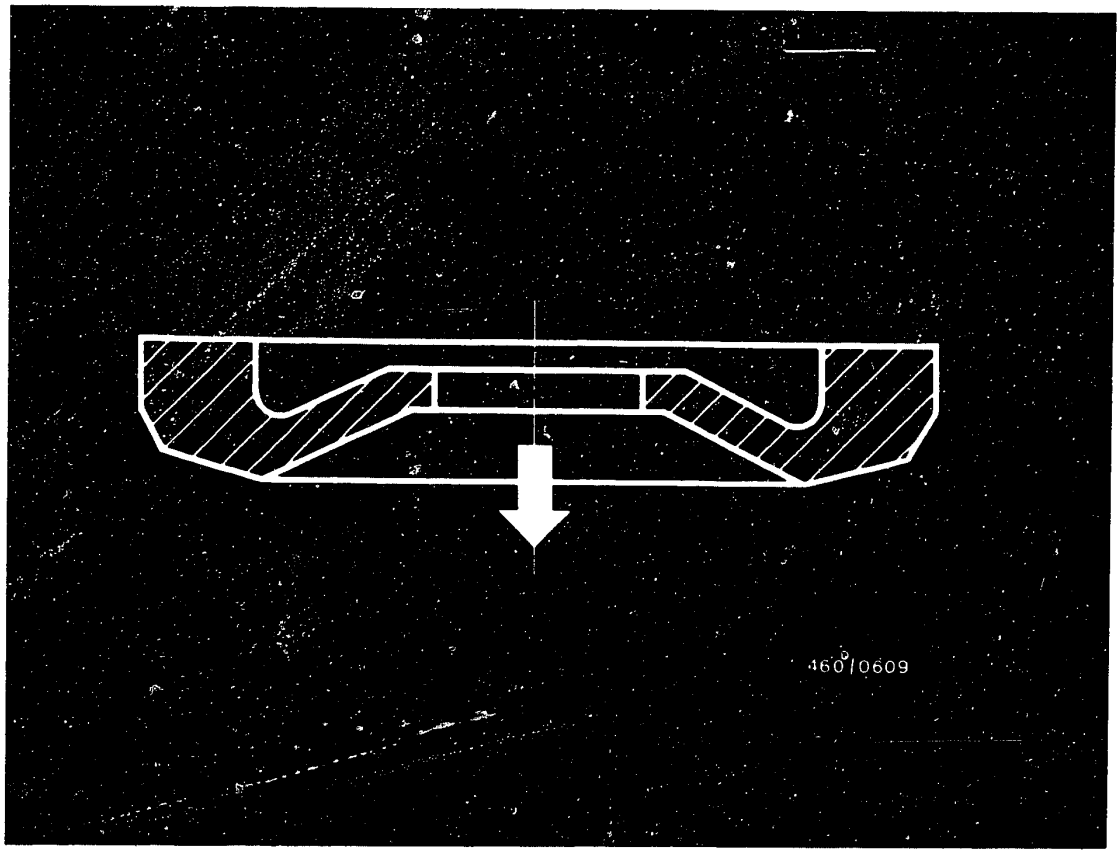
Remove the nozzle-and-holder assembly.
Introduce nozzle needle into device 1 688 130 153 (1) and tighten clamping nut by hand.
Connect device to nozzle tester and raise pressure until oil escapes from the overflow valve.
With further, uniform and slow movement of the lever (4...6 seconds for one downward movement of the hand lever), a fine, clear, axial cord spray must escape from the center bore (longitudinal bore) of the nozzle needle (arrow).

If no cord spray is visible, the longitudinal bore must be cleaned using the appropriate cleaning needle of the nozzle cleaning kit, or the complete nozzle must be replaced.

21.8 Cleaning the nozzle needle

If no cord spray is visible, the longitudinal bore must be cleaned using the nozzle cleaning kit KDEP 2900, or the nozzle must be replaced.
For the version of nozzle with a short pintle (bore diameter 0.15 mm), use cleaning needle KDEP 2900/3 (0.13 mm diameter). For nozzles as of FD 345 (bore diameter 0.20 mm), use cleaning needle KDEP 2900/5 (bore diameter 0.18 mm), also for nozzles with long pintle (bore diameter 0.20 mm).
Being a special accessory, the needle with 0.13 mm diameter is not included in the nozzle cleaning kit. It must be ordered separately; the needle with 0.18 mm diameter is included in KDEP 2900.

Note:
Nozzle needle and nozzle body are mated and must not be mixed up.

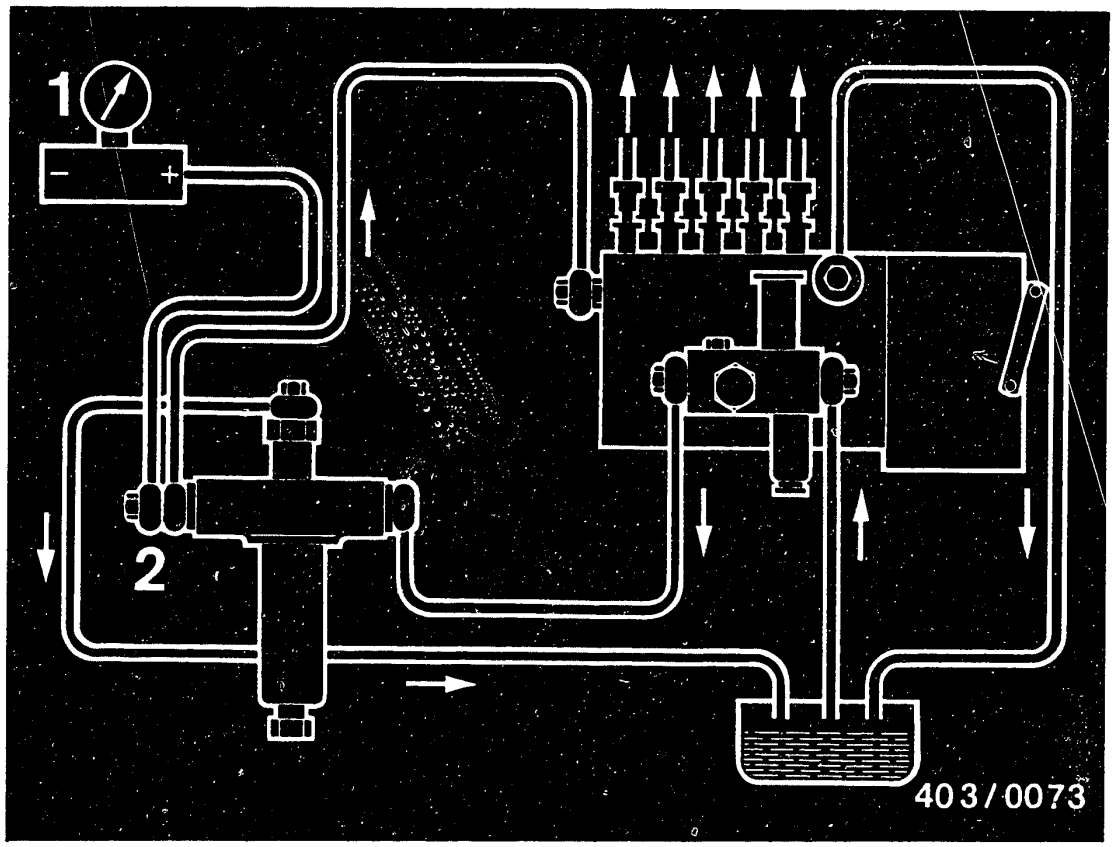


21.9 Install injection nozzles

Before installing the injection nozzles, insert new thermal protection discs, the right way round (arrow), in the cylinder head (sealing cone 150° toward combustion chamber).

Screw in nozzle holder and tighten to 70...80 Nm.

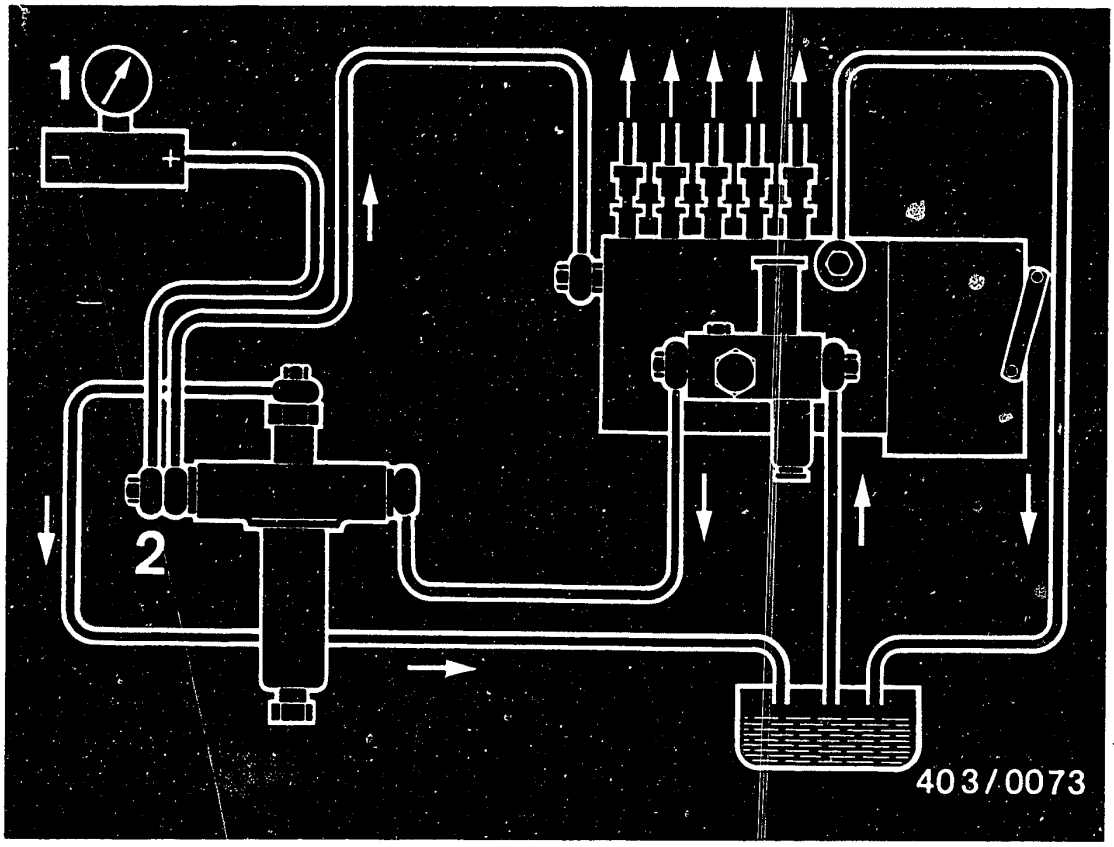
Tighten union nuts of fuel-injection tubing to 10...20 Nm.



1 = Differential-pressure gauge
2 = Filter outlet (use inlet union and over-long inlet-union screw 2 443 456 020)

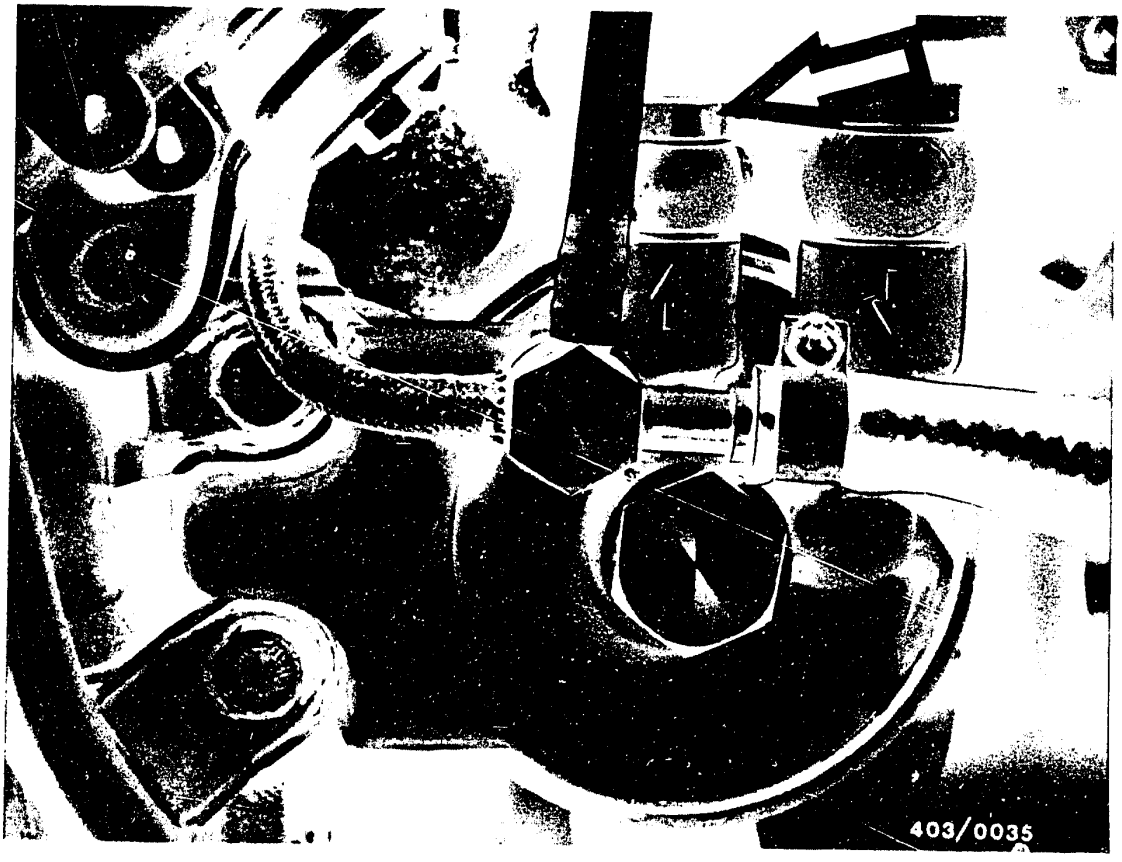
22. TEST FUEL DELIVERY PRESSURE

Connect differential-pressure gauge to fuel filter using appropriate connecting parts.



Remove inlet-union screw from main fuel filter.

Connect (+) side of differential-pressure gauge (1) to the fuel line with a double inlet-union screw (2) to the main fuel filter.



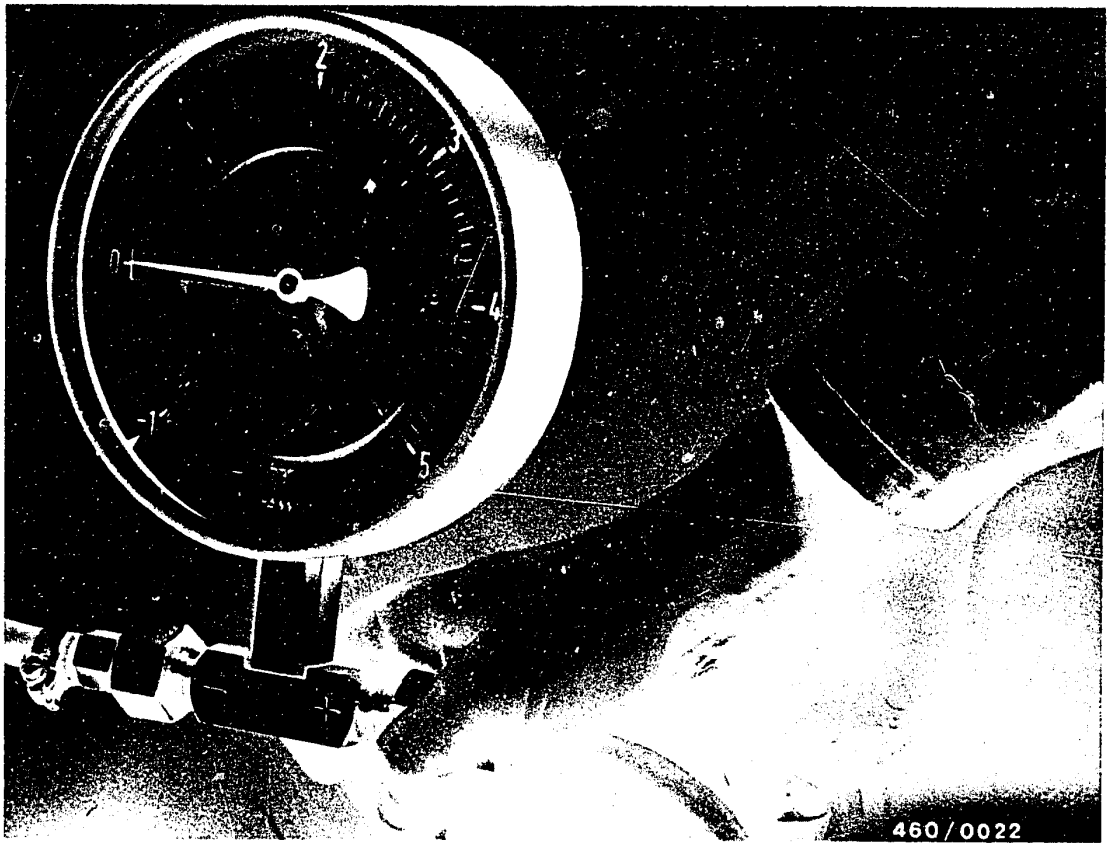
Fill fuel filter and fuel-injection pump with diesel fuel.

Loosen double inlet-union screw (arrow) on fuel filter.

Loosen operating knob of hand primer and operate hand primer until the fuel escaping from the inlet-union screw is free of bubbles.

Re-tighten double inlet-union screw.

Using the hand primer, pump until the overflow valve of the injection pump opens (audible chattering noise). Tighten operating knob of hand primer.



Let the engine run until normal operating temperature (+80°C cooling water temperature) has been reached.

Measure the fuel delivery pressure at idle speed and at 3000 min^{-1}.

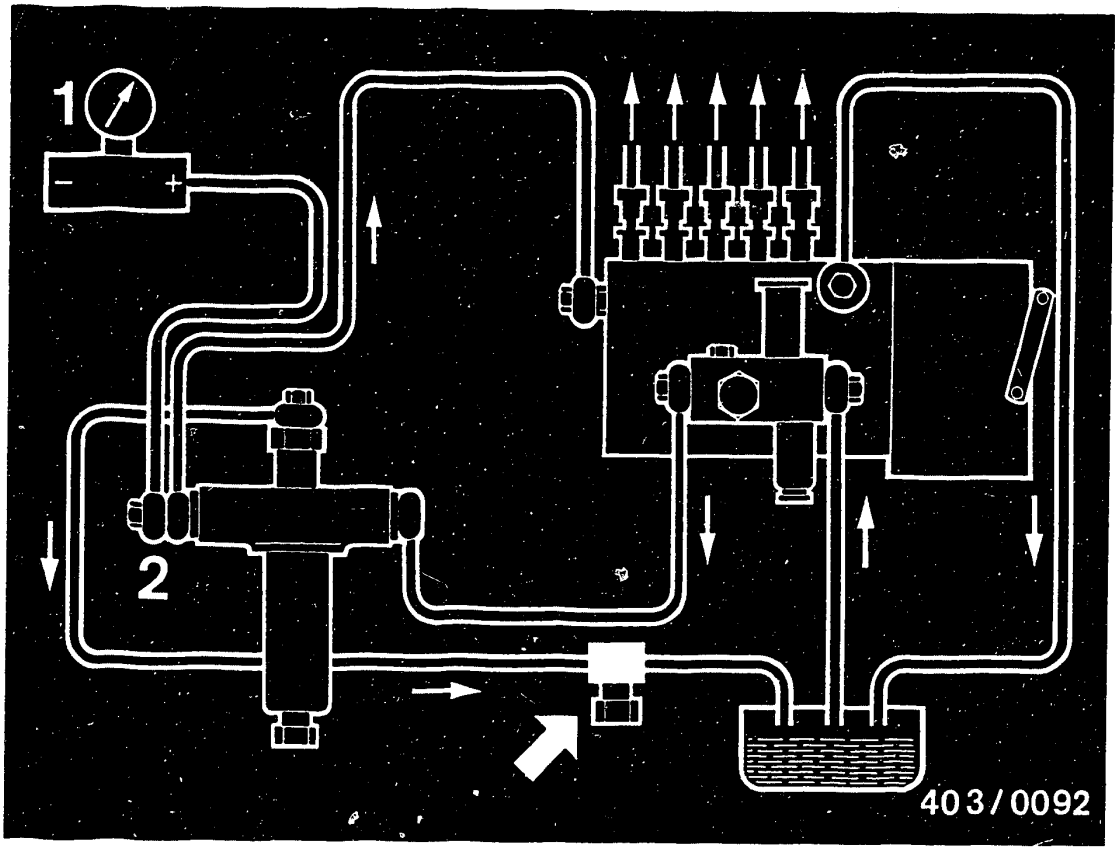
At idle speed: 0.6...0.8 bar gauge pressure

At 3000 min^{-1}: min. 0.8 bar gauge pressure

Read off these values on the black pointer.

If these values are not obtained, check the following points:

- Remove overflow valve on injection pump, dismantle and clean.
- Check fuel filter for fouling. If necessary, fit new filter element with housing and gasket.
- Replace intake and delivery valves or replace fuel pump.



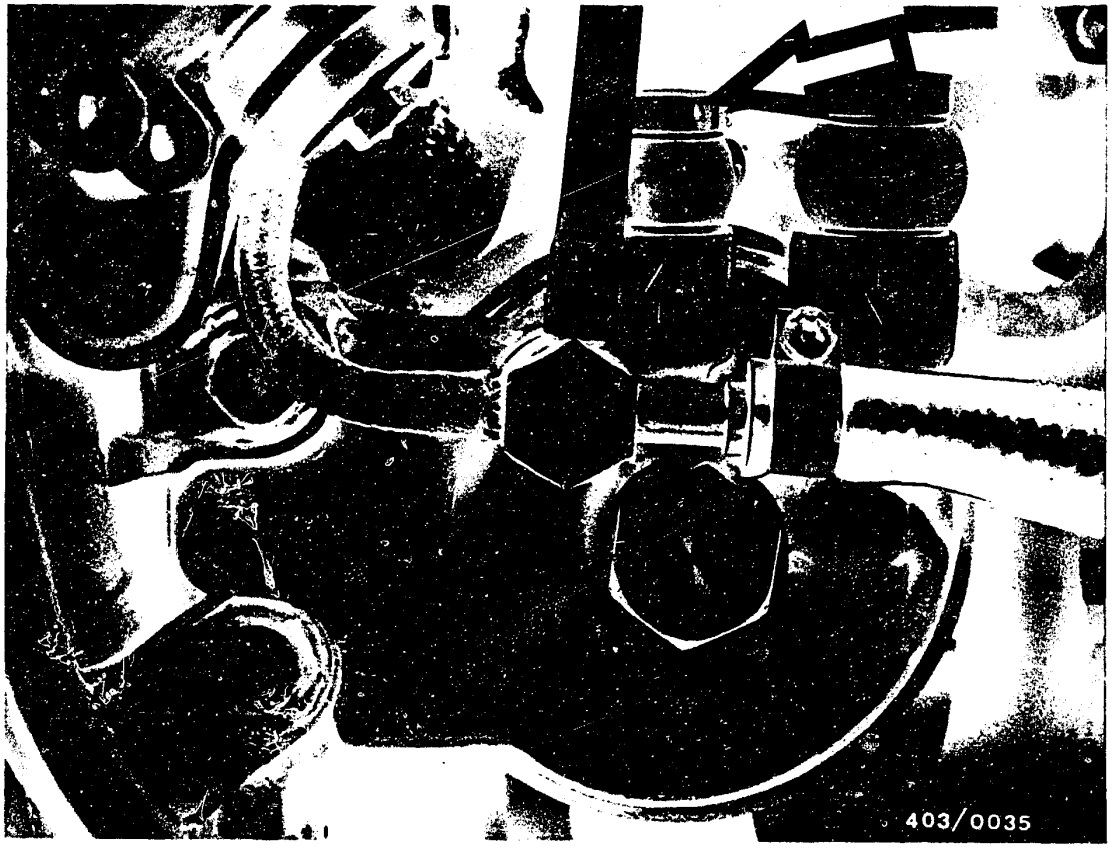
22.1 Test final fuel delivery pressure

Press together fuel return hose with a clamp (arrow).

Measure final fuel delivery pressure at idle speed and at 3000 min^{-1}.

At idle speed:	min. 1.1 bar gauge pressure
At 3000 min^{-1}:	min. 1.3 bar gauge pressure

If the final delivery pressure is too low:
Replace intake and delivery valves or replace fuel pump.
Remove differential-pressure gauge and connect fuel lines to fuel filter.



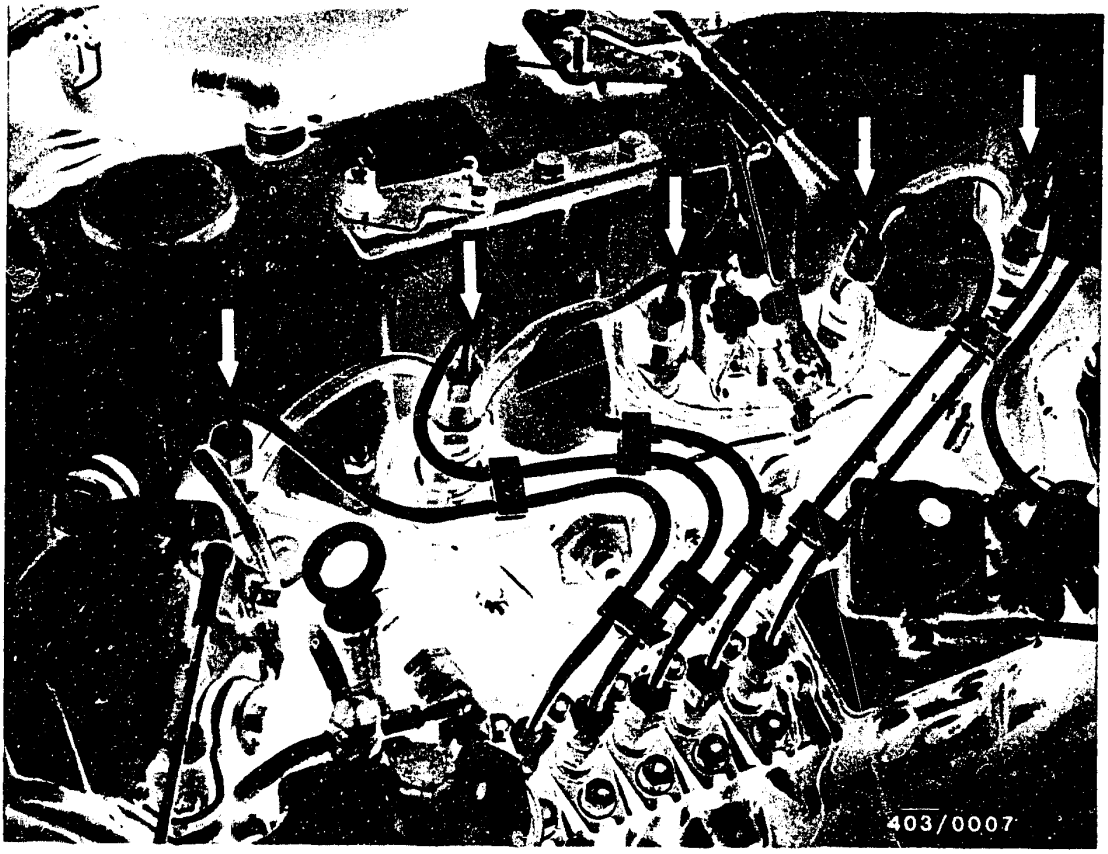
22.2 Bleed fuel system

Fill fuel filter and fuel-injection pump with diesel fuel.

Loosen inlet-union screw (arrow) on fuel filter.

Loosen operating knob of hand primer and operate hand primer until fuel escaping from inlet-union screw is free of bubbles.

Re-tighten inlet-union screw.



Loosen union nuts of fuel-injection tubing at injection nozzle holders.

Operate starting motor of engine without preheating until fuel escapes from union nuts of injection nozzle holders.

Tighten union nuts.

Operate starting motor until engine starts.

23. TEST PREHEATING SYSTEM

23.1 Necessary test equipment

VA tester	e.g. ETT 011.00	0 684 101 100
Multimeter with digital display		Commercially available

23.2 Workshop information

We recommend replacing the R-type sheathed-element glow plugs every 45 000 km.

Note:
If the start of delivery is incorrectly set, this can considerably shorten the service life of the sheathed-element glow plug.

For each repeat start, it is necessary - in order to obtain renewed preheating - to turn the glow-plug and starter switch first of all to position 1, and then to position 2. This makes it possible for the safety circuit in the glow-duration unit to be re-activated.

23.3 Preheating time

The on-time of the preheating system is dependent on the ambient temperature.

23.4 Test conditions

Battery fully charged. Compression O.K. If necessary, test compression loss. Fuel supply/injection system O.K.

23.5 Fault indication

A fault in the preheating system is indicated by the failure of the glow-plug indicator lamp to light up with the glow-plug and starter switch in position 2.
The following faults are covered:

- Open circuit in lead term. 30 on glow-duration unit
- Fuse 80 A defective.
- Power relay in glow-duration unit defective
- Open circuit of one or more leads to sheathed-element glow plugs
- One or more sheathed-element glow plugs defective

23.6 Test preheating system (1980 model year)

Check main circuit of preheating system for open circuit

Glow-plug indicator lamp does not remain with glow-plug and starter switch in position "2"
Main circuit O.K.?

no →

Malfunction:
Glow-plug indicator lamp flashes for approx. 30 sec with switch in position "2".
1. Check voltage at term. 30 of glow-duration unit to ground.
If no voltage, check lead between engine lead set cable connector and glow-duration unit term. 30 for open circuit.
Eliminate open circuit.
2. If voltage, check 80 A fuse for security/open circuit.
Replace fuse.
If points 1 and 2 O.K., replace glow-duration unit.

yes ↓

Check bulb, temperature sensors of preheating system and their leads

Glow-plug indicator lamp lit when ready to start?

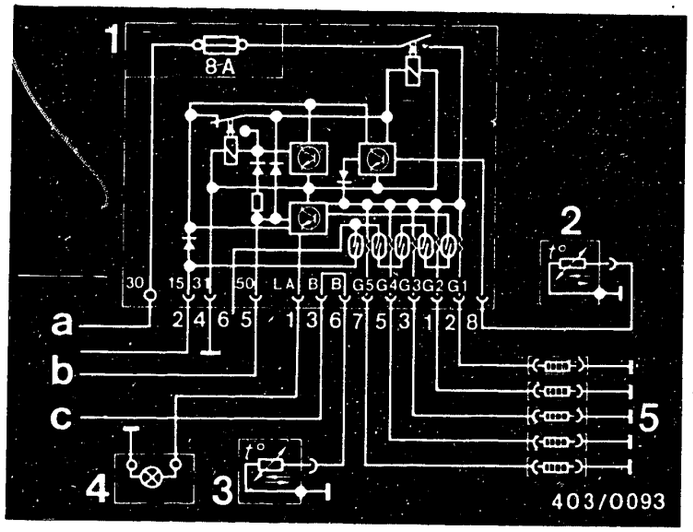
no →

Disconnect 6-pin connector from glow-duration unit. Turn key to position "2". Jump sockets 1 and 2 of connector (bottom diagram). If glow-plug indicator lamp not lit, check bulb and replace if necessary. If bulb O.K., check lead from connector socket 1 from glow-duration unit to glow-plug indicator lamp for open circuit.
Eliminate open circuit.

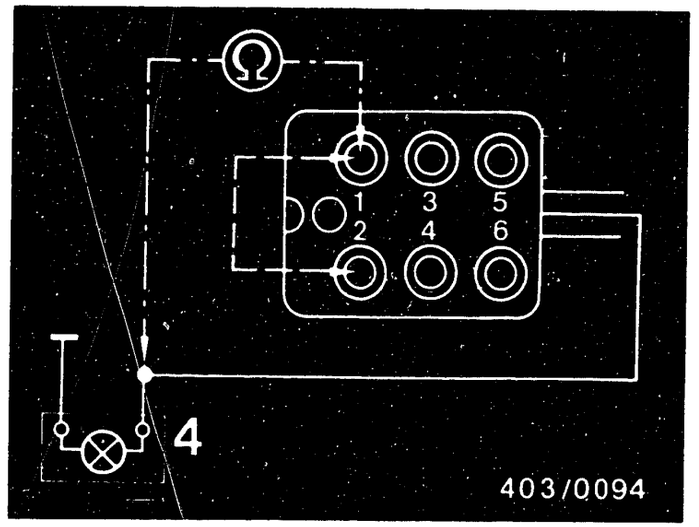
yes ↓

Continued on F6/F7

Continued on F6/F7



1 = Glow-duration unit
2 = Preheating system temperature sensor
3 = Coolant temperature sensor
4 = Glow-plug indicator lamp
5 = Sheathed-element glow plugs
a = To cable connector term. 30
b = Relay
Air conditioner/starting motor term. 50
c = Instrument cluster connector socket 3



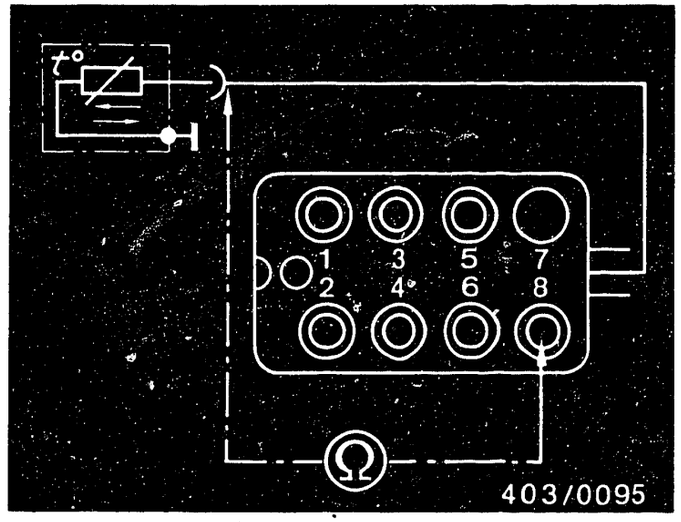
Test preheating system (1980 model year) (continued)

If glow-plug indicator lamp lit, check lead from 8-pin connector socket 8 from glow-duration unit to temperature sensor for open circuit (top diagram). Eliminate open circuit.

If no open circuit is found, test temperature sensor/replace (center diagram).
Resistance values of temperature sensor at coolant temperature of:

0°C: 8200 Ω
25°C: 2440 Ω
80°C: 290 Ω

If temperature sensor O.K., replace glow-duration unit.

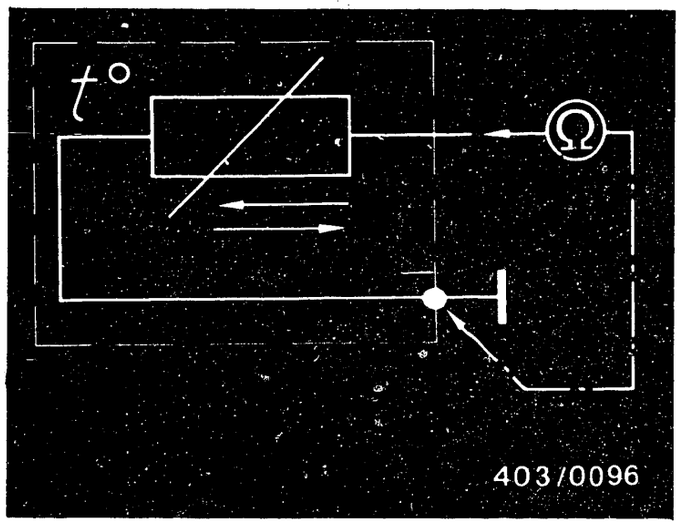


yes

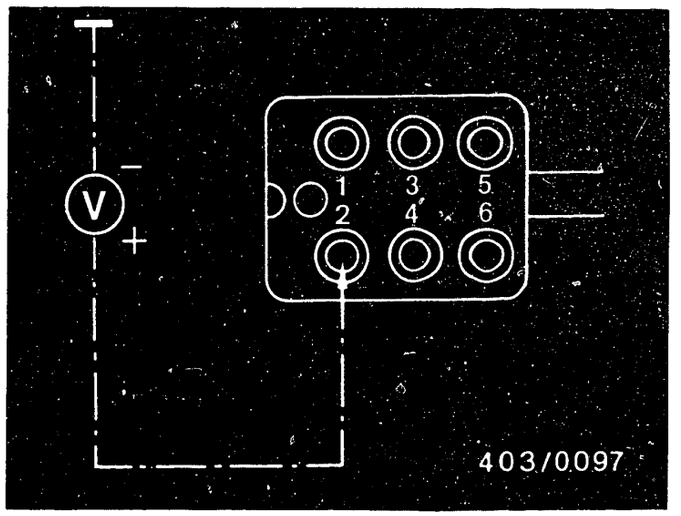
Check energization of glow-duration unit. Glow-plug indicator lamp lit?

no

Disconnect 6-pin connector from glow-duration unit. Turn key to position "2".
Test voltage at socket 2 (term. 15) to ground (bottom diagram).



yes



Continued on F11/F12

Continued on F8/F9

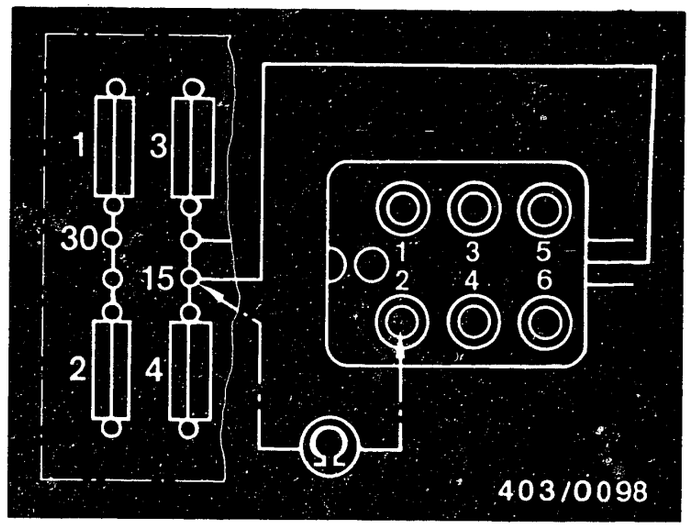
Test preheating system (1980 model year) (continued)

If no voltage (approx. 12 V), check lead between fuse box term. 15 and connector socket 2 of glow-duration unit for open circuit (top diagram). Eliminate open circuit.

If voltage, connect voltmeter to socket 2 (term. 15) and socket 4 (term. 31) and test voltage (bottom diagram).

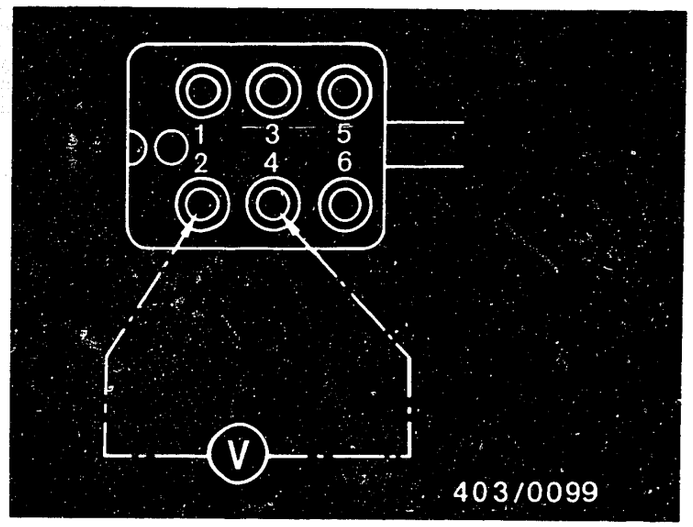
If no voltage (approx. 12 V) indicated, check lead between socket 4 and ground for open circuit. Eliminate open circuit.

If voltage indicated, replace glow-duration unit.



yes

Continued on F10/F11



Test preheating system (1980 model year) (continued)

Test sheathed-element glow plugs and their leads.

Glow-plug indicator lamp must not flash after starting or after attempt to start?
O.K.?

no →

Malfunction
Glow-plug indicator lamp flashes for approx. 30 sec after starting or after attempting to start.

Disconnect 8-pin connector from glow-duration unit.
Measure resistance, one after the other, at sockets 1...5 (corresponding to sheathed-element glow plugs of cyl. 1...5) to ground (engine block)(top diagram).

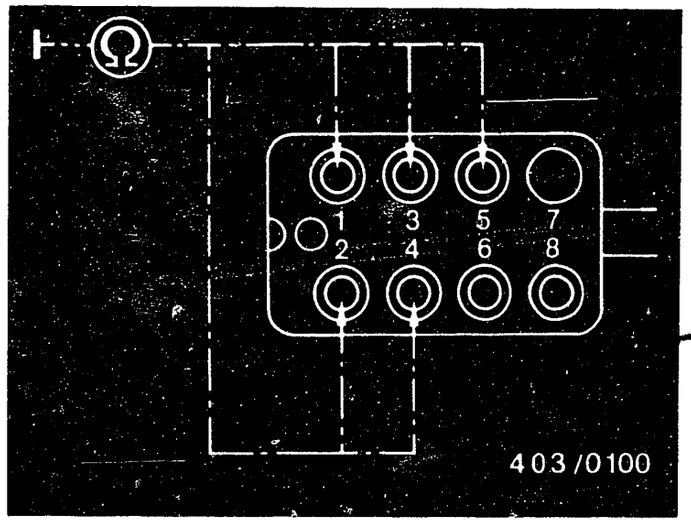
If a resistance of ∞ Ω is measured, there is an open circuit in the respective sheathed-element glow plug or in its lead or its connection.

If a low resistance (e.g. < 1 Ω at +20°C) is measured, the lead and the sheathed-element glow plug are O.K.

Note on testing the current consumption:
With increasing heating (after approx. 10... 25 sec) the inherent resistance of the glow plug increases and limits the current to approx. 8 A.
If the current consumption is above 8 A, replace sheathed-element glow plug.

yes ↓

Testing of preheating system (1980 model year) completed.



24.7 Test preheating system (as of 1981 model year)

Check main circuit of preheating system for open circuit.
Glow-plug indicator lamp lit?
Switch in position "2"

no →

1. Test voltage at term. 30 of glow-duration unit to ground. If no voltage (approx. 12 V), test lead for open circuit. Eliminate open circuit. On type 126, from distributor terminal 30 to glow-duration unit (term. 30).

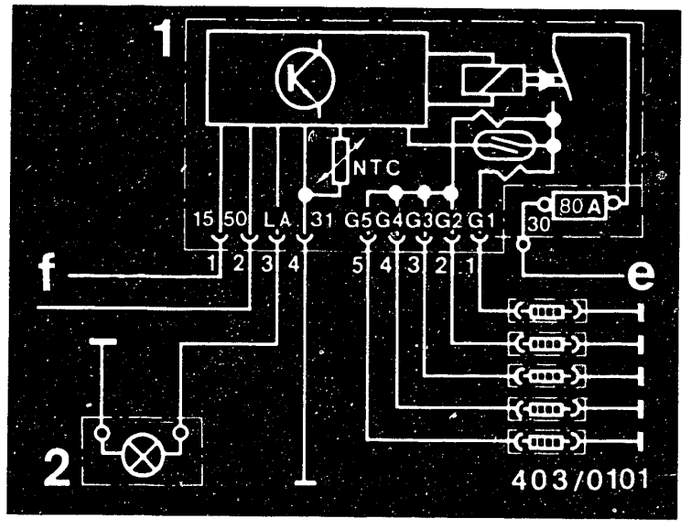
2. If voltage, check 80 A fuse for security/open circuit.
If points 1 and 2 O.K., check glow-duration unit.

3. Test voltage at socket 1 of 4-pin connector on glow-duration unit to ground.
If no voltage with preheating system on, check lead from fuse box term. 15 to connector socket 1 of glow-duration unit for open circuit. Eliminate open circuit.
Note (bottom diagram).
Access fuse no. 14 to connector socket 1 of glow-duration unit.

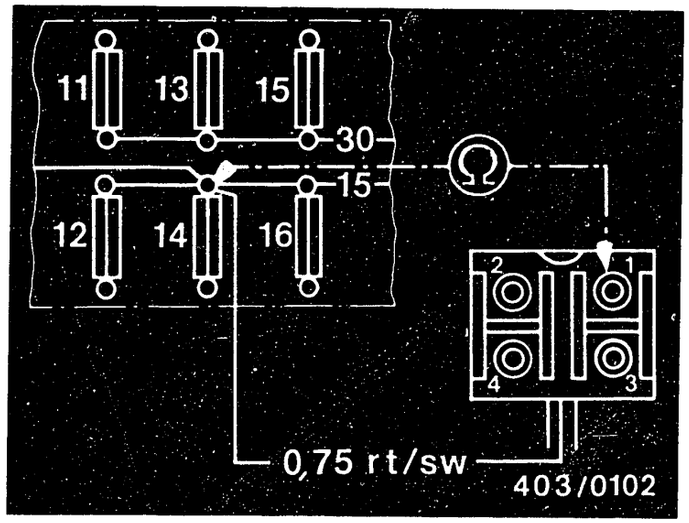
yes

Continued on F14/F15

Continued on F14/F15



1 = Glow-duration unit
2 = Glow-plug indicator lamp
e = To support point in fuse box terminal 30
f = To fuse box term. 15



Test preheating system (as of 1981 model year) (continued)

Glow-plug indicator lamp lit despite readiness for starting?

yes

If voltage, connect voltmeter to socket 1 (term. 15) and socket 4 (term. 31) and measure voltage.

If no voltage indicated, check lead from socket 4 to ground for open circuit.
Eliminate open circuit.

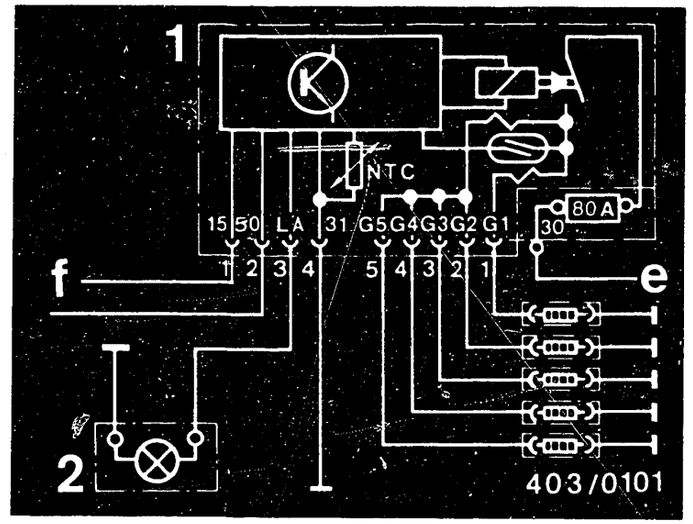
If point 9 O.K., replace glow-duration unit.

no

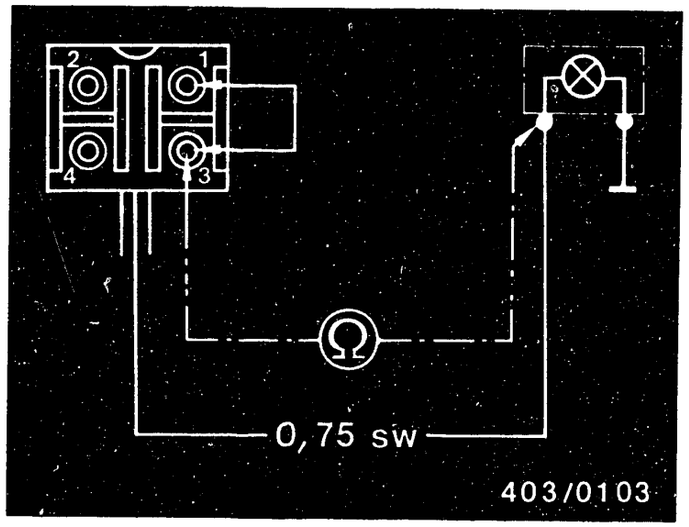
Disconnect 4-pin connector from glow-duration unit.
Turn key to position "2". Jump sockets 1 and 3 of connector (bottom diagram).
If glow-plug indicator lamp not lit, test/replace bulb.
If bulb O.K., check lead from connector socket 3 from glow-duration unit to glow-plug indicator lamp for open circuit.
Eliminate open circuit.
If glow-plug indicator lamp lit, replace glow-duration unit.

yes

Continued on F16/F17



1 = Glow-duration unit
2 = Glow-plug indicator lamp
e = To support point in fuse box terminal 30
f = To fuse box term. 15



Test preheating system (as of 1981 model year) (continued)

Check preheating time
Glow-plug and starter switch in position 2. The preheating time (glow-plug indicator lamp lit) depends on the engine temperature (see graph).

Preheating time (seconds) O.K.?

no → Replace glow-duration unit.

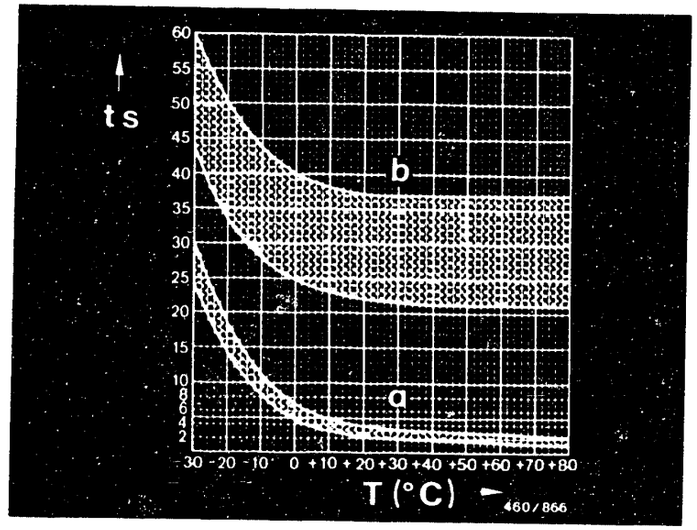
yes

Check safety switch-off
Connect voltmeter to R-type sheathed-element glow plug and to ground. Set to position 2. The time of the safety switch-off is no longer rigidly specified. It results from the time up to readiness to start (going out of the glow-plug indicator lamp) plus 20-35 seconds. During this time the voltmeter must indicate voltage (see graph).
After this time, the voltmeter must indicate 0 V. Voltmeter at 0 V after specified time?

no → Replace glow-duration unit.

yes

Continued on F18/F19



t_s = Time in seconds
T(°C) = Engine temperature
a = Preheating time
b = Safety switch-off

Test preheating system (as of 1981 model year) (continued)

Does engine start well? And is glow-plug indicator lamp lit during preheating?

no

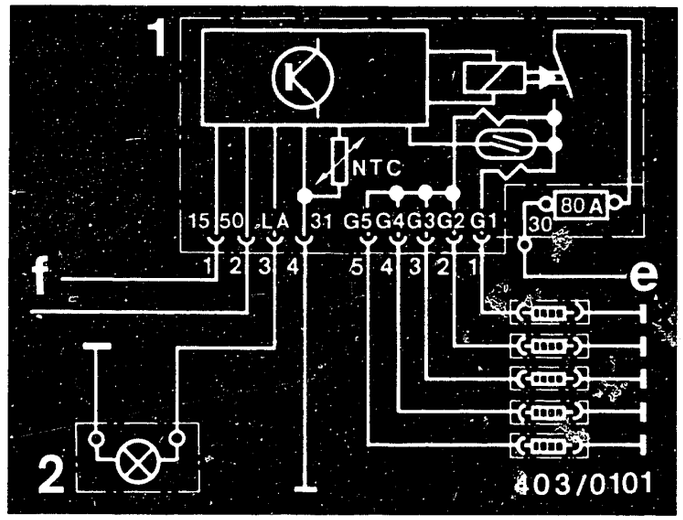
Check sheathed-element glow plugs for open circuit:
Disconnect 6-pin connector from glow-duration unit.
Using ohmmeter, measure resistance, one after the other, at sockets 1...5 (corresponding to sheathed-element glow plugs of cyl. 1...5) to ground (engine block).

If a resistance of ∞ Ω is measured, there is an open circuit in the respective sheathed-element glow plug or in the lead or its connection. If a low resistance (e.g. < 1 Ω at +20°C) is measured, the lead and the sheathed-element glow plug are O.K.

Note:
It is possible that (as a result of unfavorable tolerances) the glow-plug indicator lamp will indicate a fault only after the failure of 2 R-type sheathed-element glow plugs in cyl. 2 to 5.
To make sure that the fault indication function in the glow-duration unit is not defective, disconnect 2 sheathed-element glow plugs of cyl. 2 to 5 and repeat preheating. If indicator lamp now indicates a fault (not lit), the glow-duration unit is O.K.

yes

Testing of preheating system (as of 1981 model) completed.

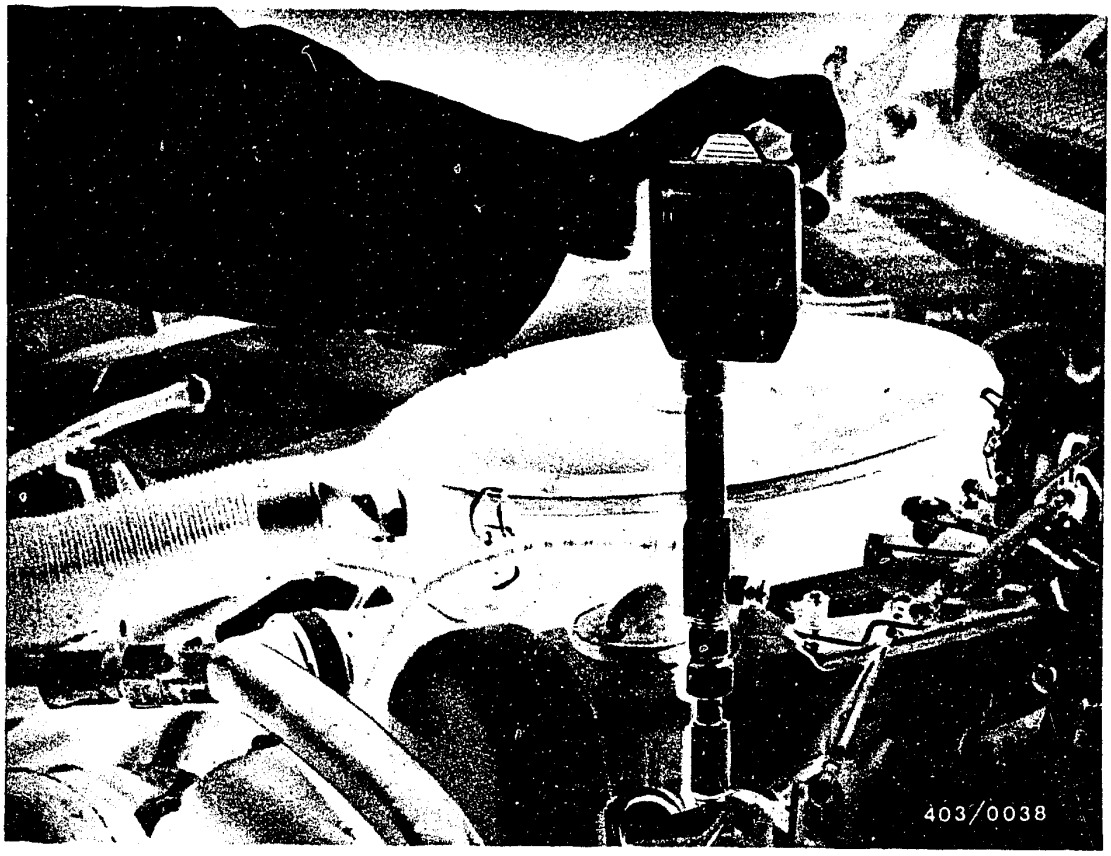


1 = Glow-duration unit
2 = Glow-plug indicator lamp
e = To support point in fuse box terminal 30
f = To fuse box term. 15

24. MEASURE ENGINE COMPRESSION AND COMPRESSION LOSS

24.1 Measure engine compression

Provide compression tester with new recording chart.
Mount high-pressure hose on compression tester.
Switch off engine.



Unscrew nozzle holder, depending on connecting nipple of compression tester.
Using the starting motor, turn the engine over several times so that loose residues are removed from the compression space.
Screw in connecting nipple.
Mount high-pressure hose of compression tester on connecting nipple.

During the following operation, pay particular attention to the first compression stroke.

Operate starting motor until there is no longer any detectable pressure rise on the compression tester.

Vent the compression tester by pressing on the vent valve.

The pointer returns to the starting position.

Move the recording sheet on to the next position.

Mount the connecting nipple on the following cylinders and repeat measurement.

24.2 Evaluation of recording chart

1. Normal pressure rise

If piston rings and valves are in good condition, the first compression stroke shows the highest pressure increase. On further compression strokes, the compression pressure builds up to the maximum pressure.

2. Gradual pressure rise

If, from the beginning, the compression pressure increases only gradually on each piston stroke, this points to burned value seats or insufficient valve guiding.

3. Low maximum pressure

If the maximum compression pressure on all cylinders is too low, this points to defective pistons, piston rings or valves.
Low compression pressure on two neighboring cylinders points to a leaking cylinder head gasket.

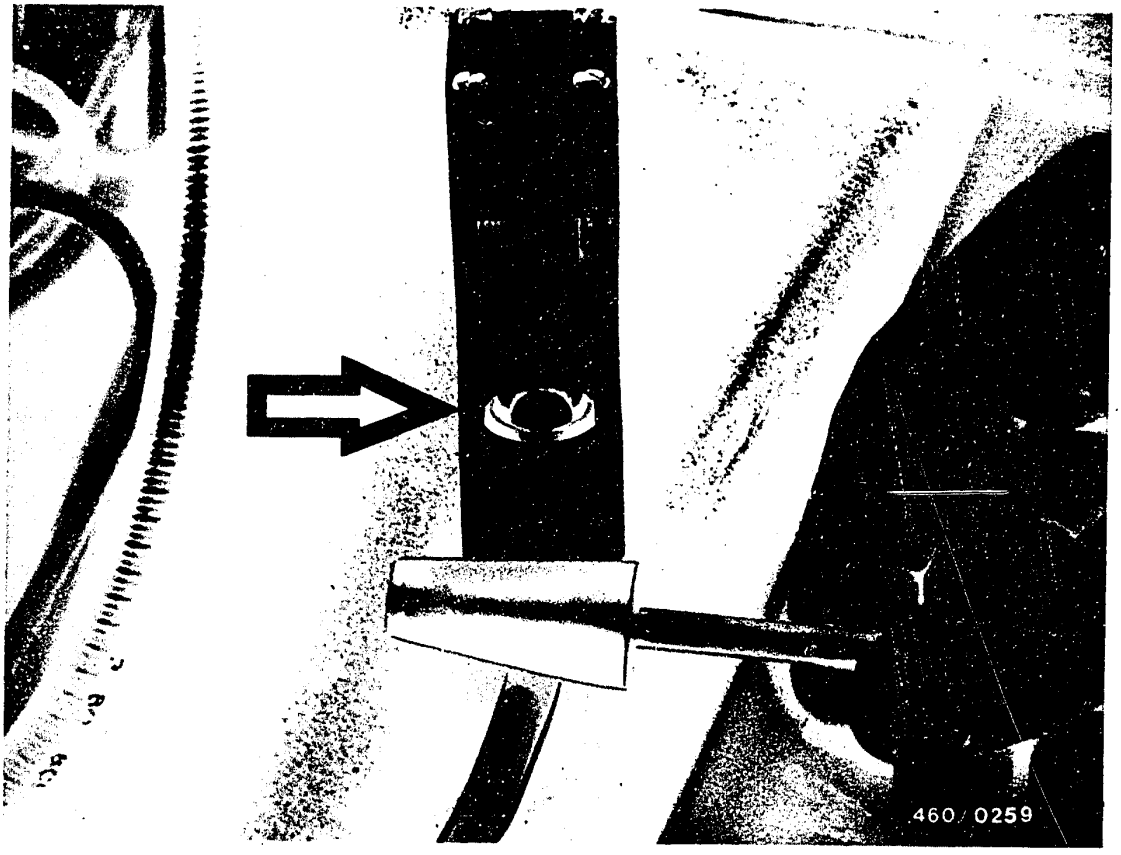
4. Differences in compression pressure

If one cylinder exhibits a clearly lower compression pressure, proceed as follows:
Pour in 2...3 cm^3 of engine oil through the opening of the sheathed-element glow plug or of the nozzle holder, and briefly operate the starting motor.

Repeat the tests and compare the recording charts. If the compression pressure on the second test is clearly higher, then there is wear to the piston rings or cylinders.
If there is no change in the result, defective valves are the cause.

5. Uniform compression pressure

Uniform compression pressure is of utmost importance as regards the smooth operation of the engine. Therefore, as high a compression pressure as possible is not the only objective.



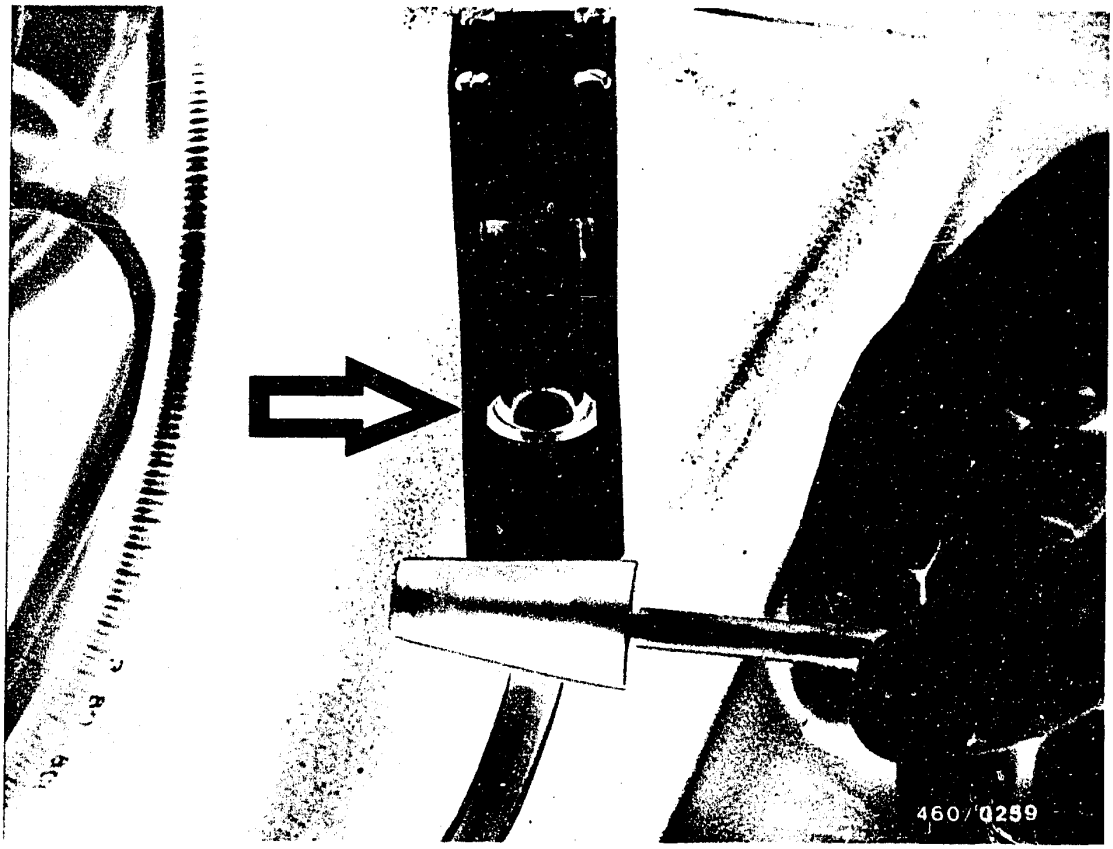
24.3 Measure engine compression loss

The BOSCH compression-loss tester 0 681 001 901 (EFAW 210 A) is used for testing.

For testing, the respective cylinder must be at TDC (TDC = top dead center) on the compression stroke.

DC detector 1 688 132 025 (included in accessories of compression-loss tester) is used for setting TDC.

Perform the test with the engine at normal operating temperature (water temperature +80°C).



24.4 Setting top dead center

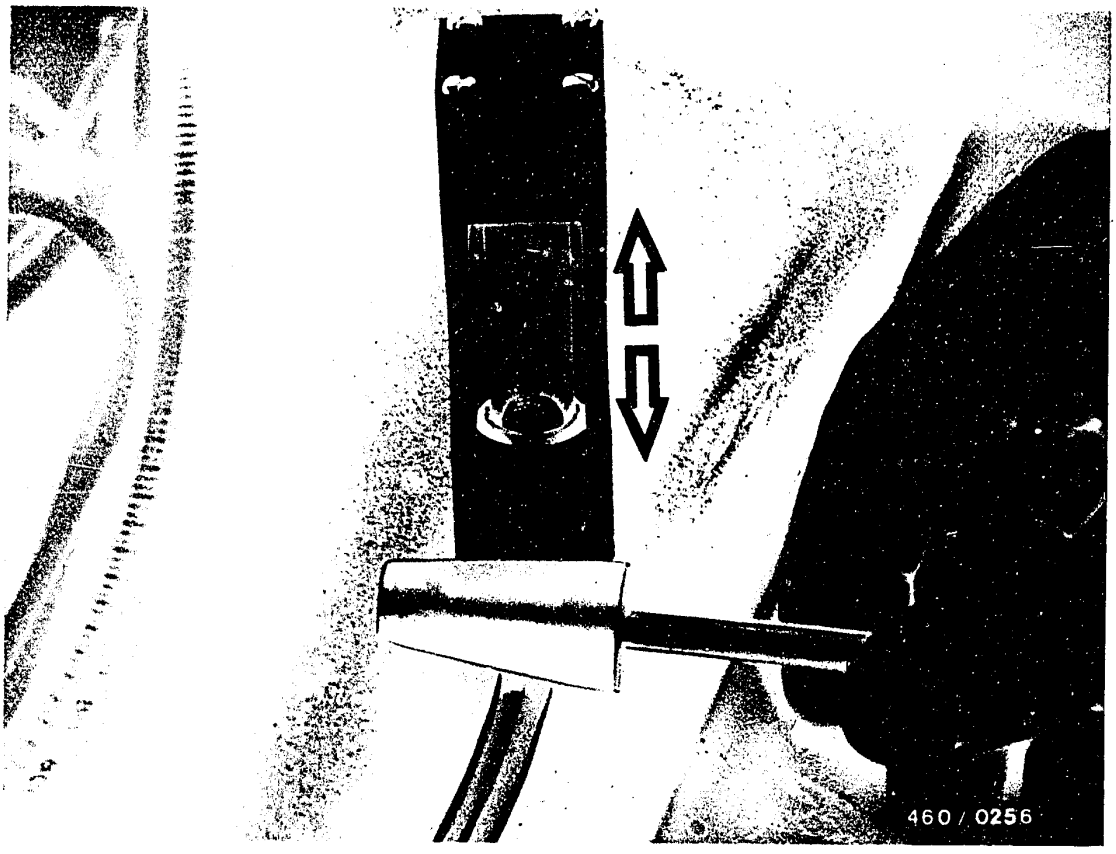
Remove sheathed-element glow plug of cylinder 1.

Insert rubber plug of DC detector into bore for sheathed-element glow plug.

Using magnetic clamp, mount glass cylinder in as vertical a position as possible in the engine compartment.

The piston of the device must be within easy view.

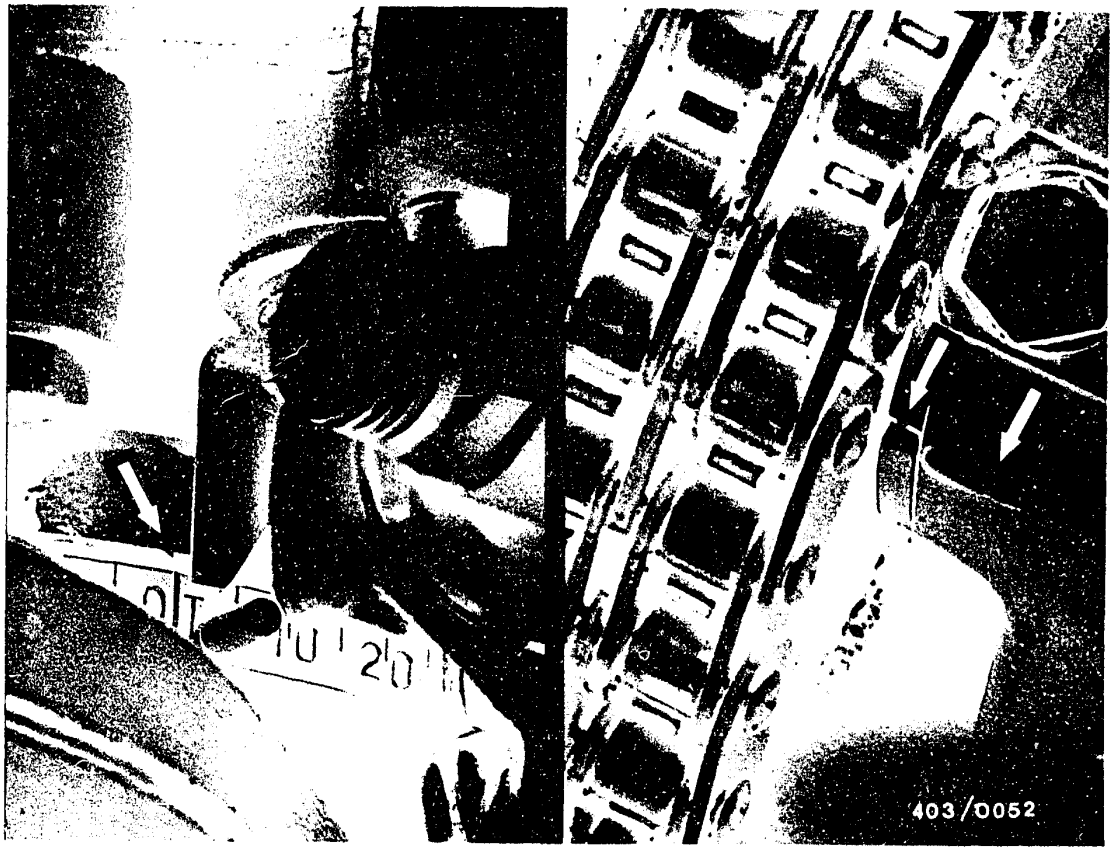
Slowly turn the engine over by hand in the engine direction of rotation.



On the compression stroke, the piston of the DC detector is forced upward.

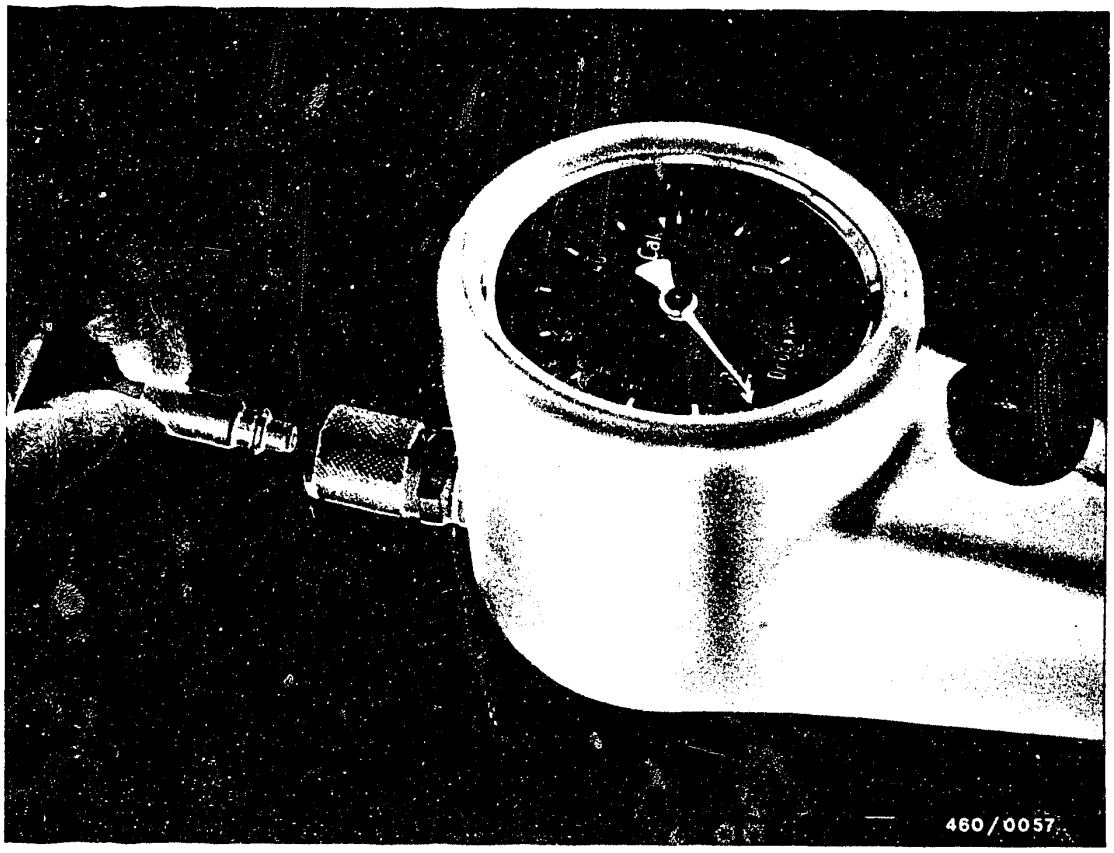
As top dead center is passed over, the piston glides down immediately.

By carefully turning the engine to and fro, find top dead center.



Note:

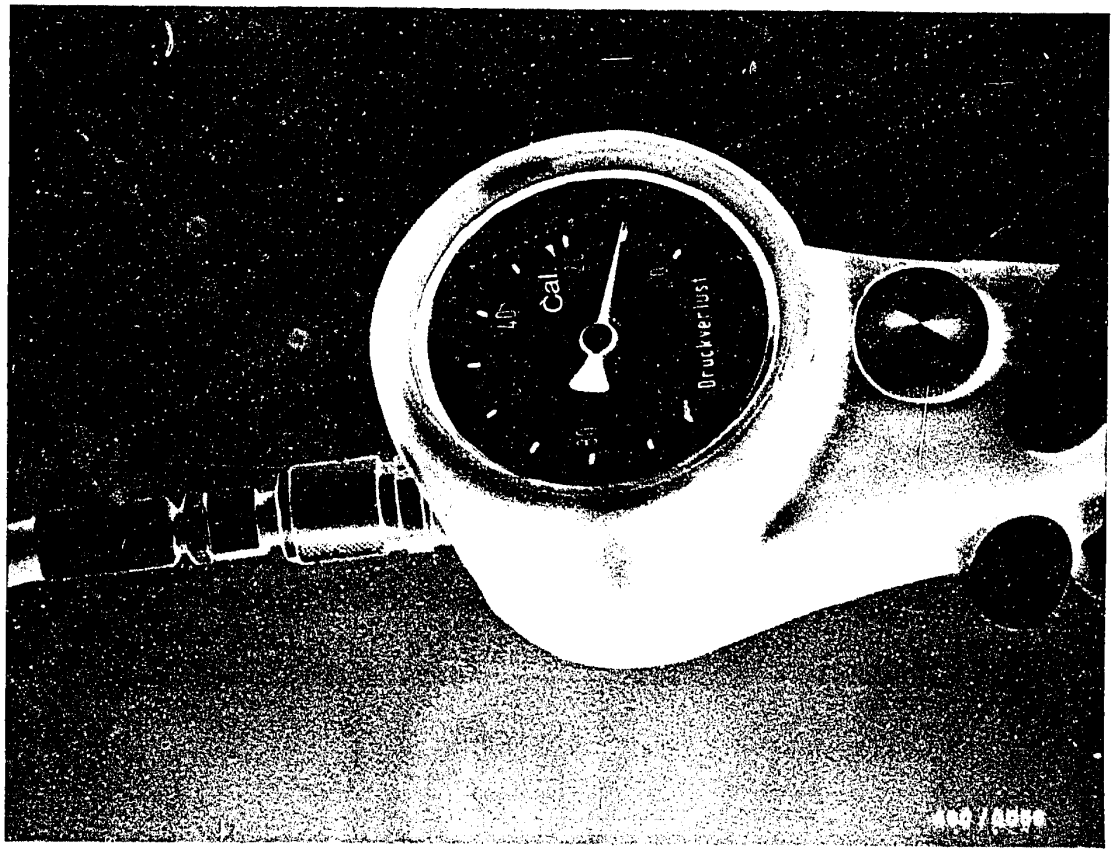
The TDC mark serves as reference point (left-hand picture, arrow).



24.5 Measuring the compression loss

Connect tester to the workshop compressed-air mains.
Connect calibrating nozzle 1 680 363 036. Set a compression loss of 23 ± 1 % ("Cal" mark) at the knurled screw of the pressure regulating valve.
Disconnect calibrating nozzle.
Pointer of measuring instrument must indicate approximately 0 % compression loss (check of equipment).

Remove sheathed-element glow plug.



Screw in connection fitting and mount test hose.

Select gear and pull on handbrake. Connect test hose to tester. Read off compression loss in % on instrument.

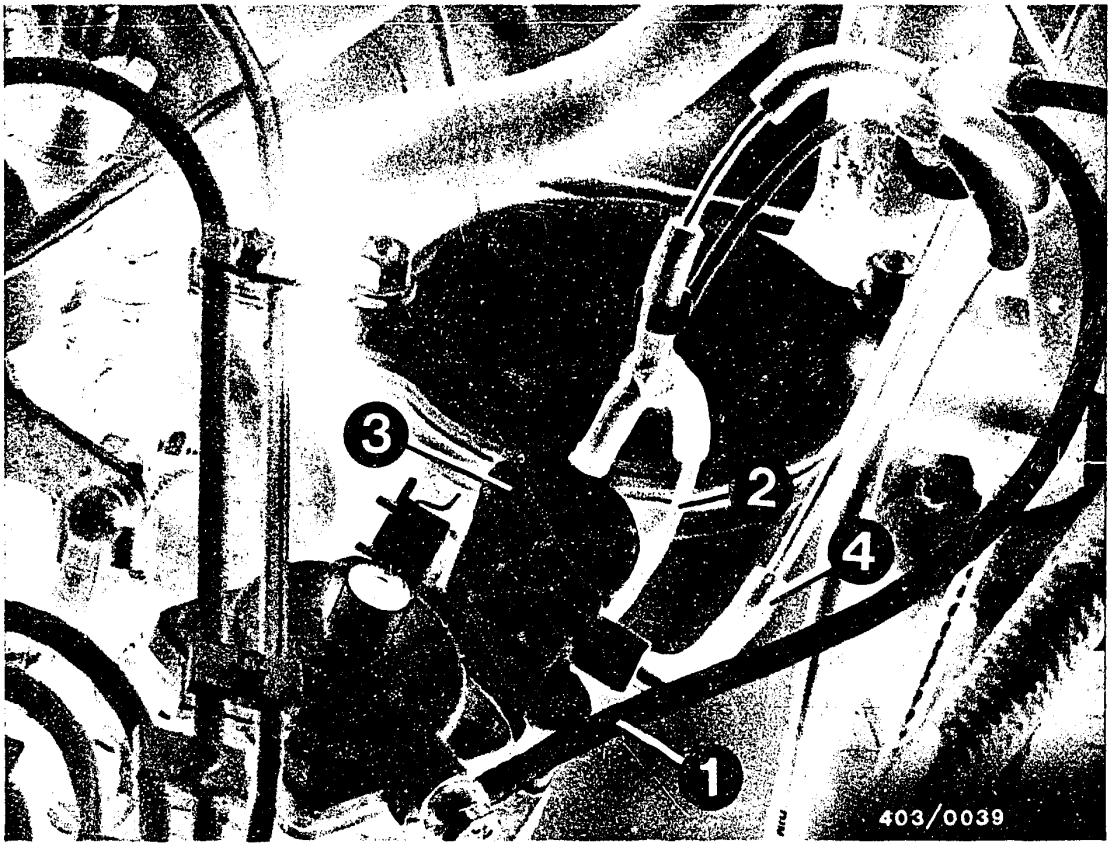
Note
Before measuring the next cylinder, briefly operate the engine with the starting motor without preheating so that the oil film re-forms.

24.6 Evaluation of test

The compression loss should not exceed 25 %. Differences between the individual cylinders of 10 % are of no importance.
Major leaks can be located because the air makes a noise as it escapes.
Listen at the following points.

Source of noise	Possible fault
Charge-air pipe (remove air filter)	Inlet valve
Exhaust manifold	Exhaust valve
Engine oil filler neck	Pistons, piston rings
Cooling water filler neck (air bubbles)	Cylinder head gasket

In order to locate the source of the fault even more accurately, pour approximately 2...3 cm^3 of engine oil into the cylinder. Repeat test.
If this time the compression loss is clearly lower, there is a fault on the piston or on the piston rings.
In the case of new engines which have not yet been broken in (less than 5000 km), higher compression losses are possible than after the breaking-in period.

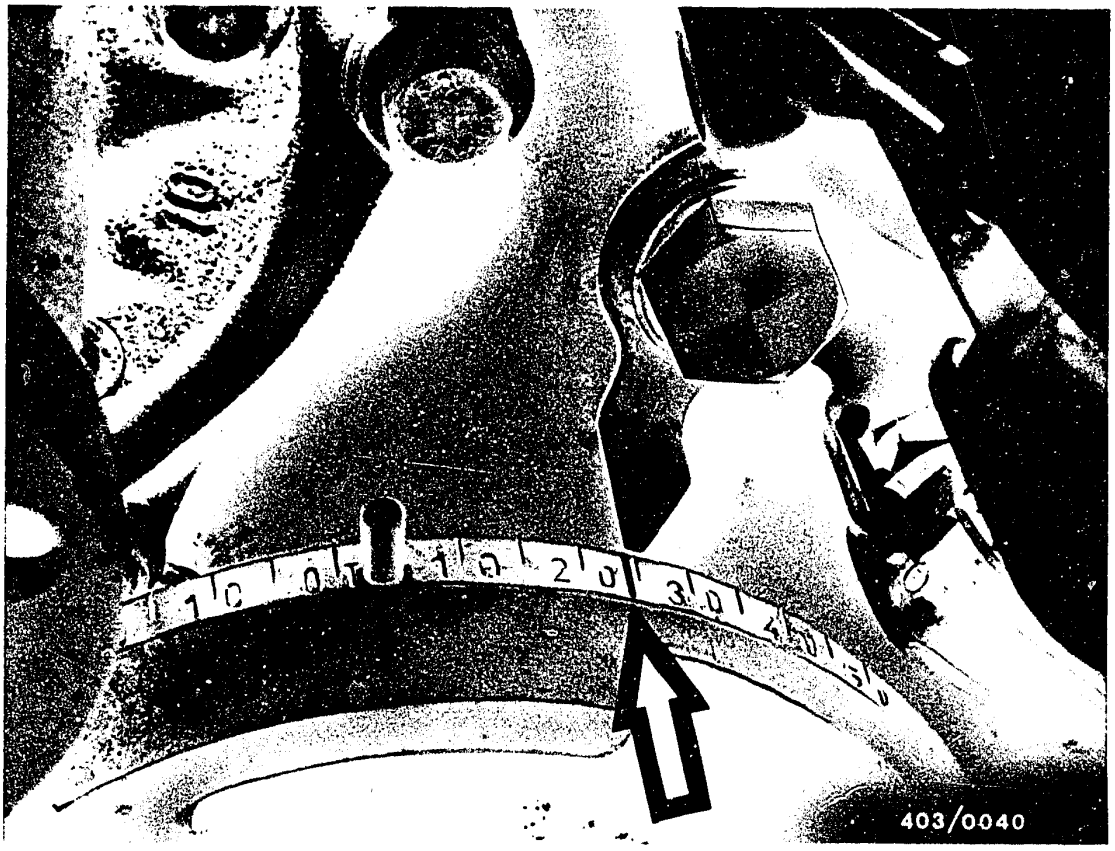


25. REMOVE FUEL-INJECTION PUMP

Disconnect negative cable from battery.

Disconnect vacuum line (2) from vacuum unit and from vacuum-control valve (3) for automatic transmissions.

Unscrew charge-air pressure line (1) on ALDA unit. Disconnect electric cable from temperature sensor (4). Unhook accelerator control linkage. Unscrew injection lines and fuel lines on injection pump.



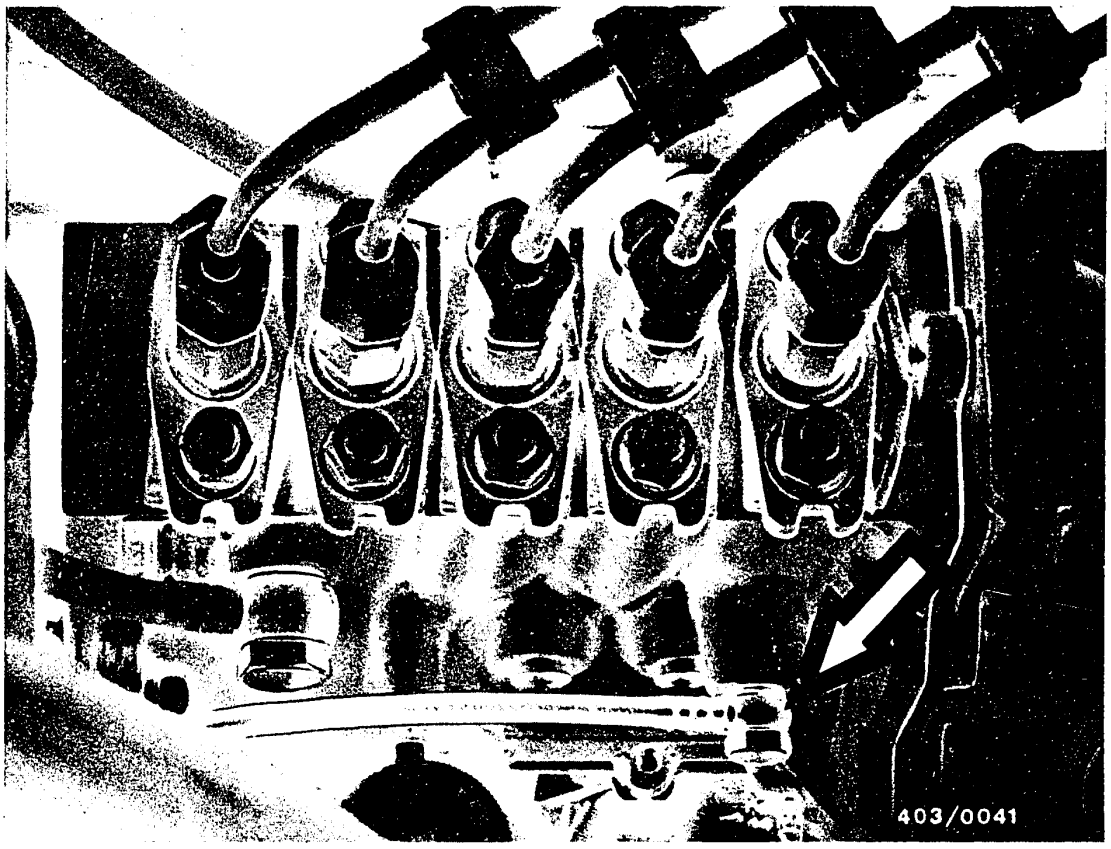
Engine positions

With start-of-delivery sensor system (FBG):

Turn crankshaft in engine direction of rotation to 15° after TDC on cylinder 1.

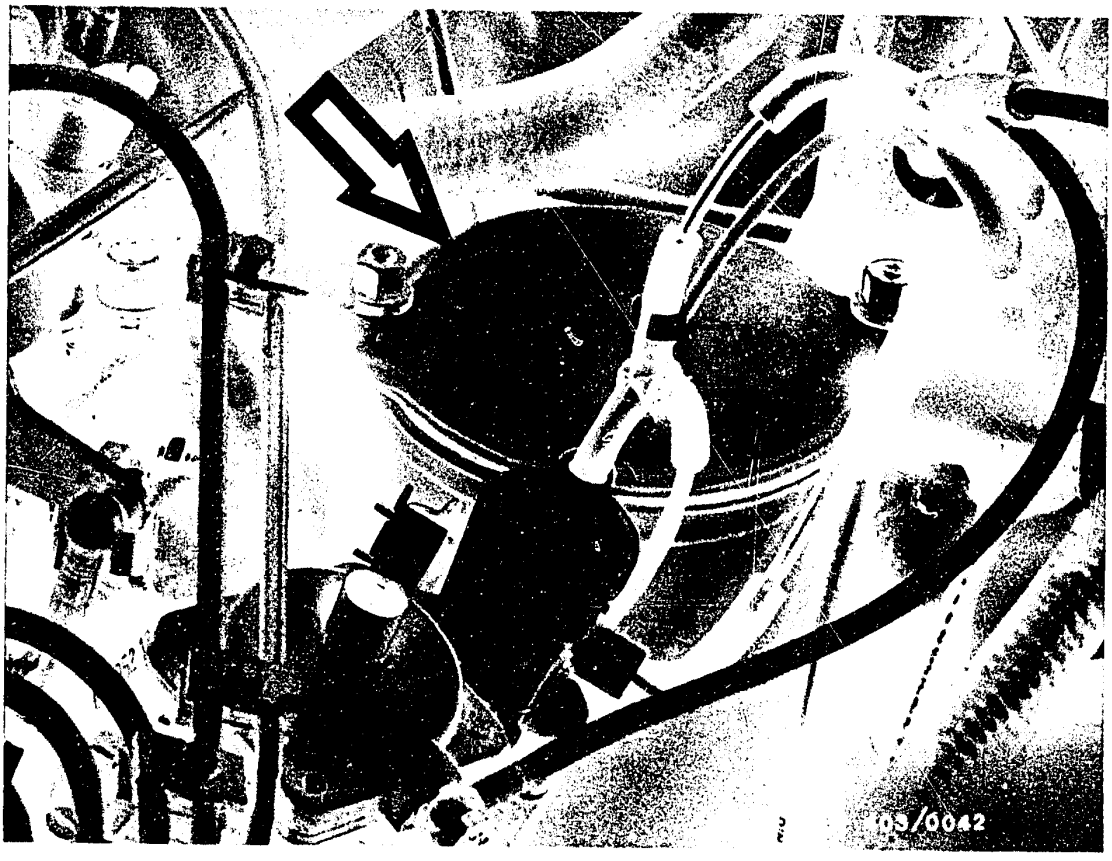
Without start-of-delivery sensor system

Turn crankshaft in engine direction of rotation to 24° before TDC on cylinder 1.

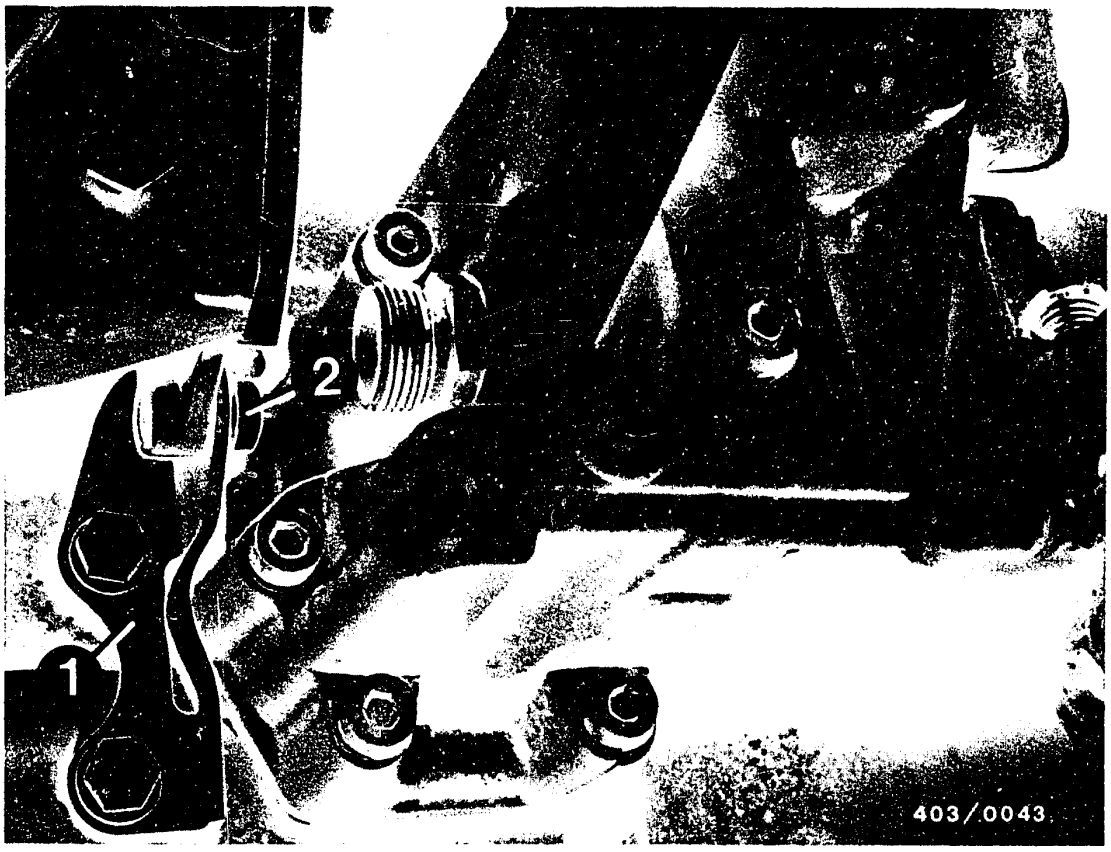


Unscrew lubricating-oil line (arrow).

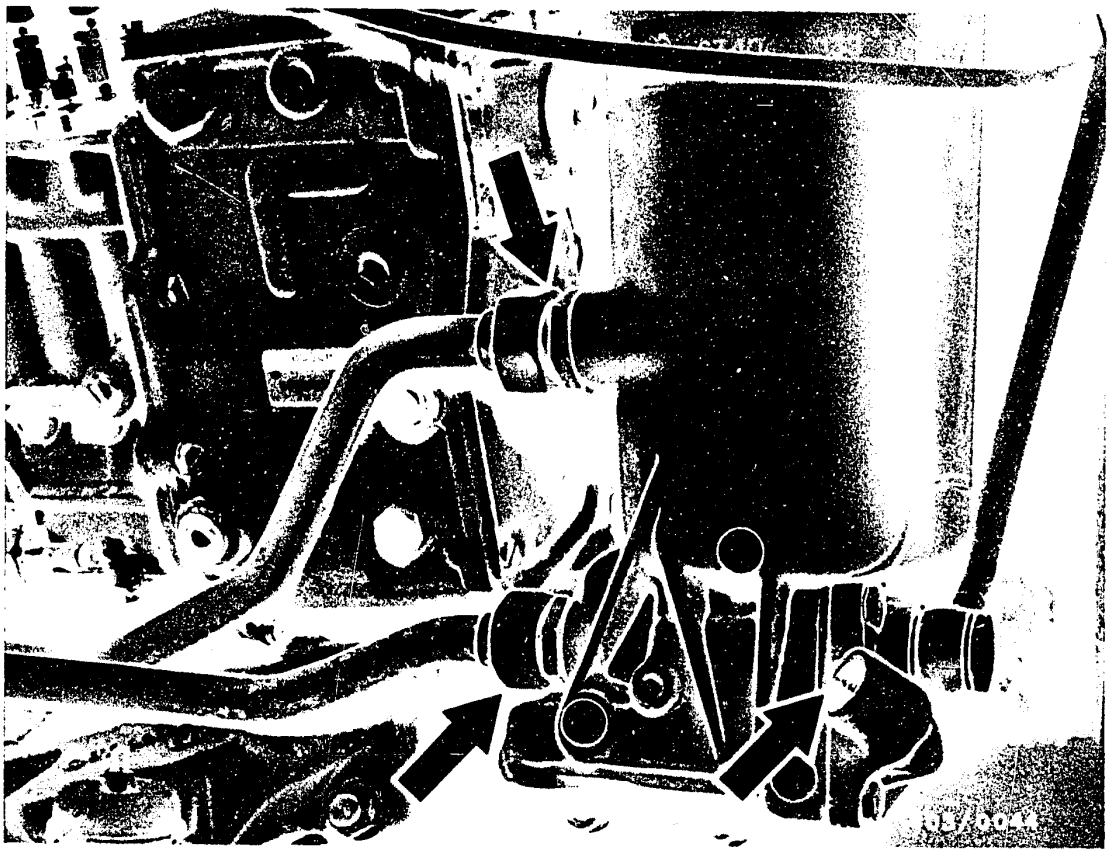
Caution
Clean connection points before removing the lubricating-oil line.



Unscrew top part of oil filter (arrow) and take out filter element so that the engine oil can flow back into the oil pan.

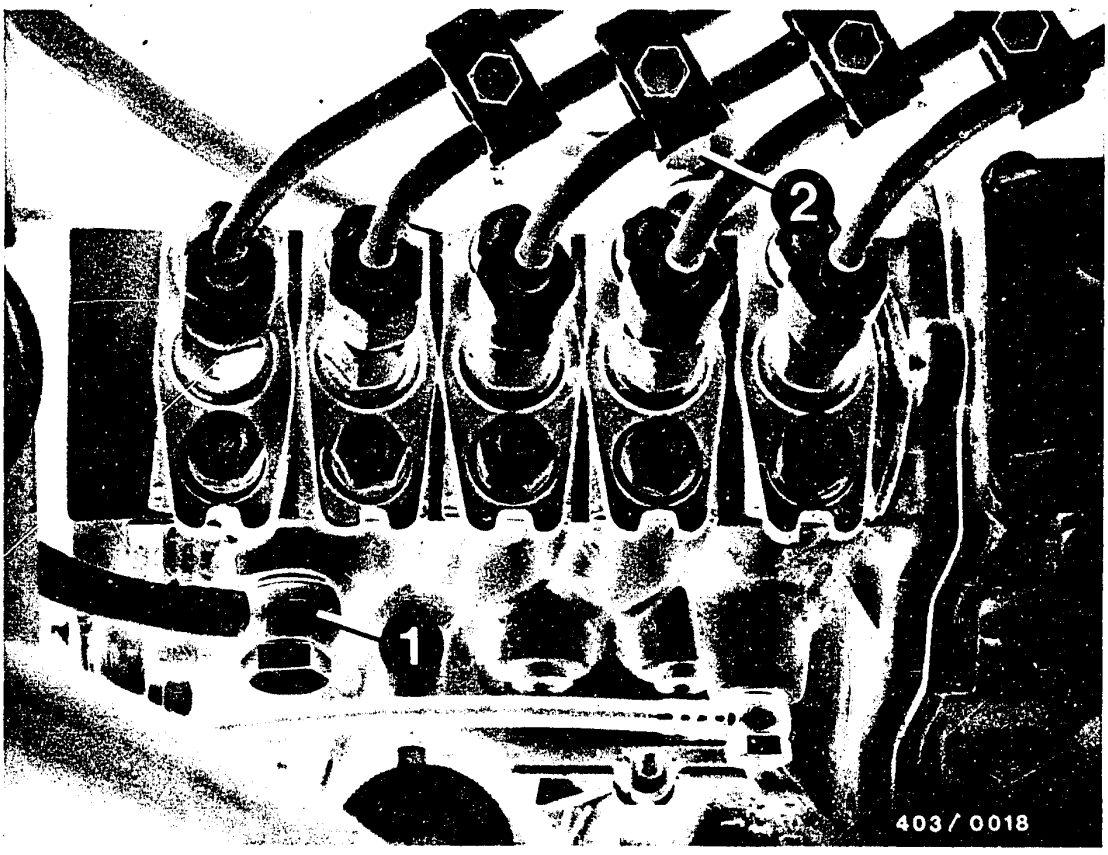


Unscrew hexagon screws on support bracket (1) and the 3 fastening nuts of the injection pump. Loosen fastening screw (2) so that an adjustment can be made within the slot.

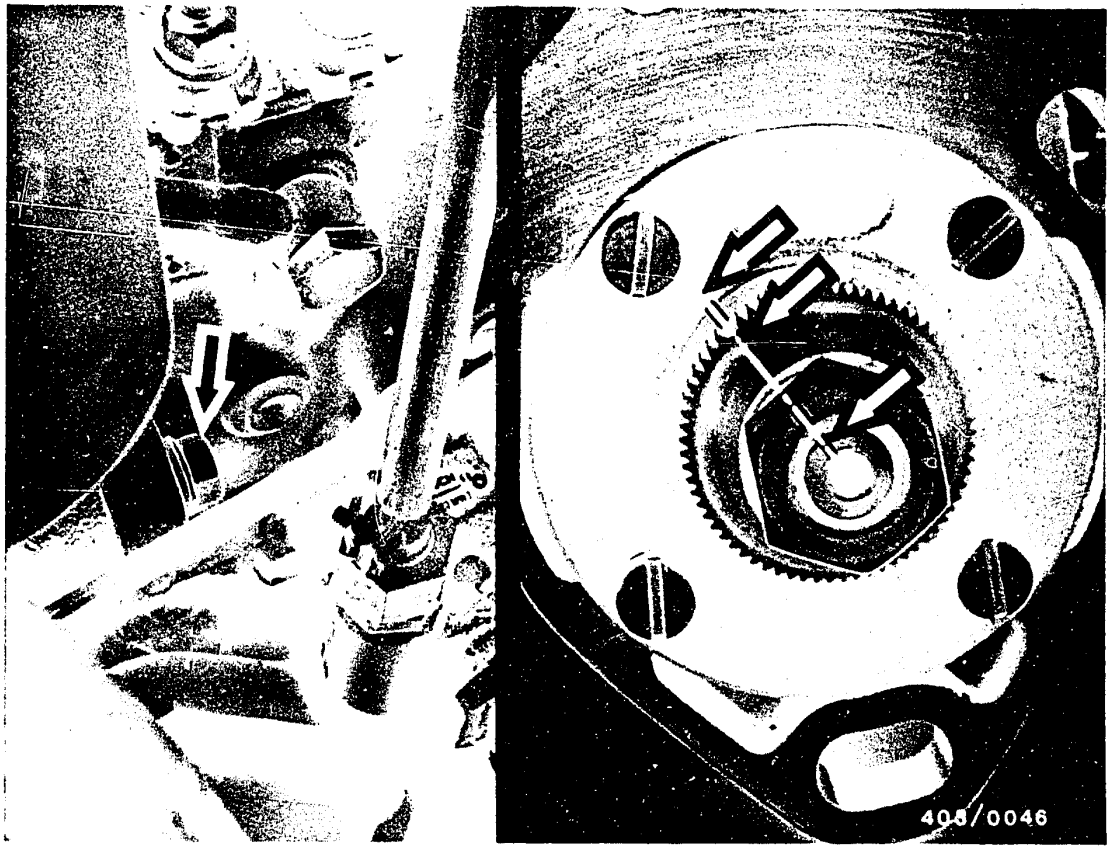


Unscrew all engine oil lines on air filter (arrows).
Loosen fastening clamps.
Unscrew oil filter housing on engine block and take out.

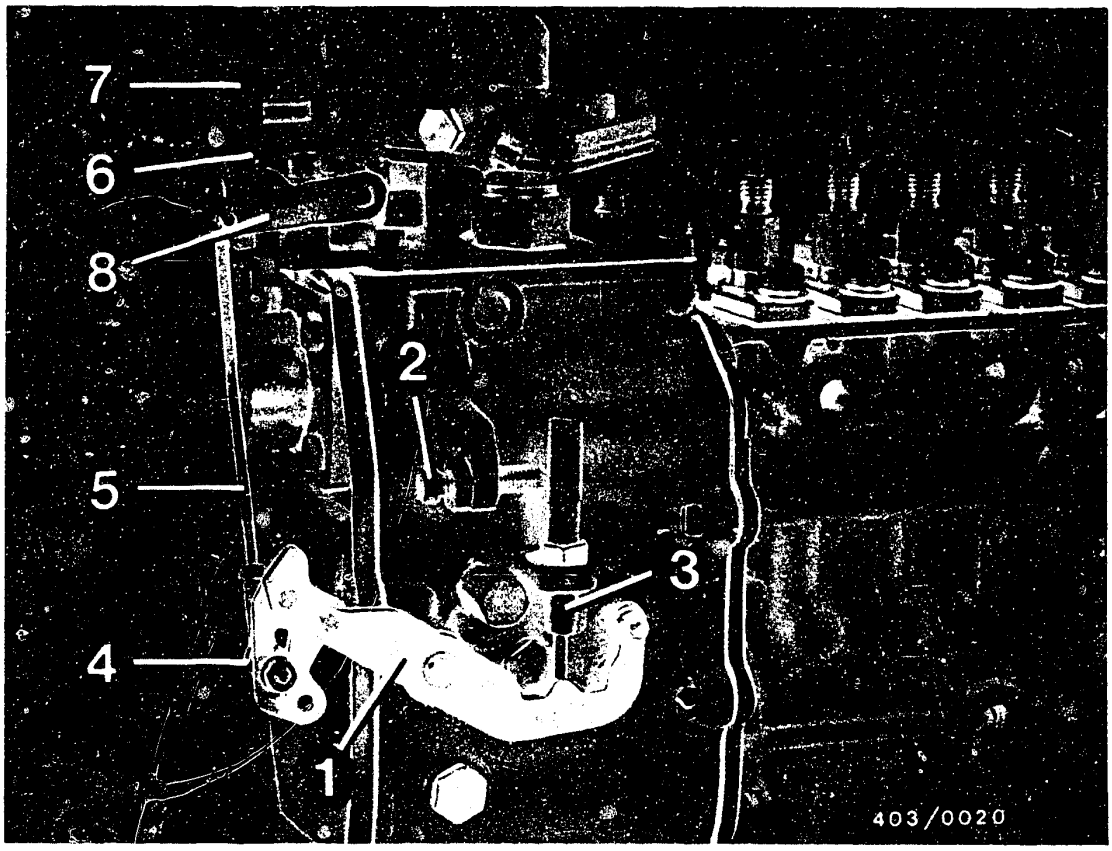
Caution
When removing the gasket, make sure that no residues drop into the oil bores.



Unscrew fuel inlet line (1) and fuel return line (2) on injection pump.
Loosen injection lines (3) using an open box wrench.
Unhook pressure rod from control lever of injection pump.



Loosen injection-pump fastening screws (left-hand picture - arrow). Withdraw injection pump out of engine block.
Remove coupling sleeve from injection-pump driver or from drive shaft.
Note:
When replacing a driver, hold it with a serrated wrench in order to loosen the hexagon nut. Remove driver from injection pump shaft using KDEP 1131. Clean shaft stub and driver; both cones must be clean and grease-free.
Mount driver with Woodruff key and hexagon nut.
Pay attention to the Woodruff key when mounting a new driver (right-hand picture).
The marks on the camshaft, driver and flange must be in alignment (arrows).



1 = Control lever
2 = Full-load stop
4 = Adjustable ball head
5 = Connecting rod
6 = Full-load stop on vacuum-control valve

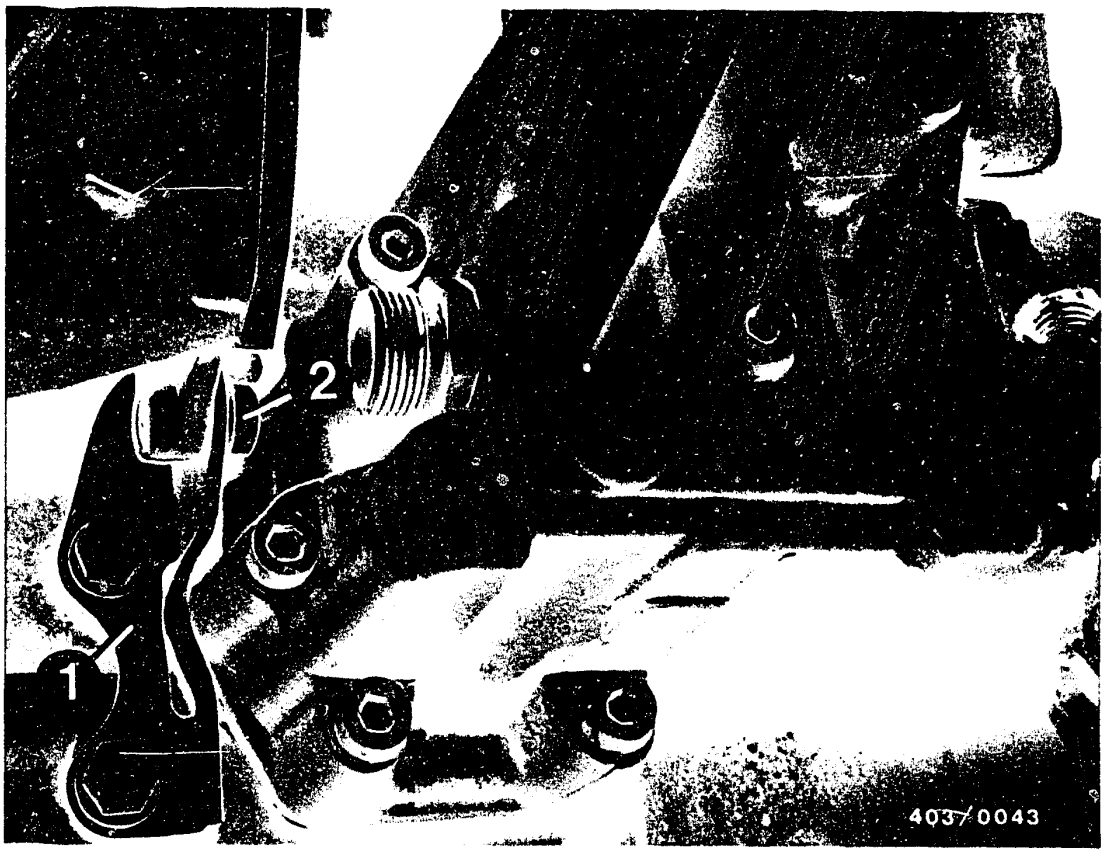
26. INSTALL FUEL-INJECTION PUMP

26.1 Preparations

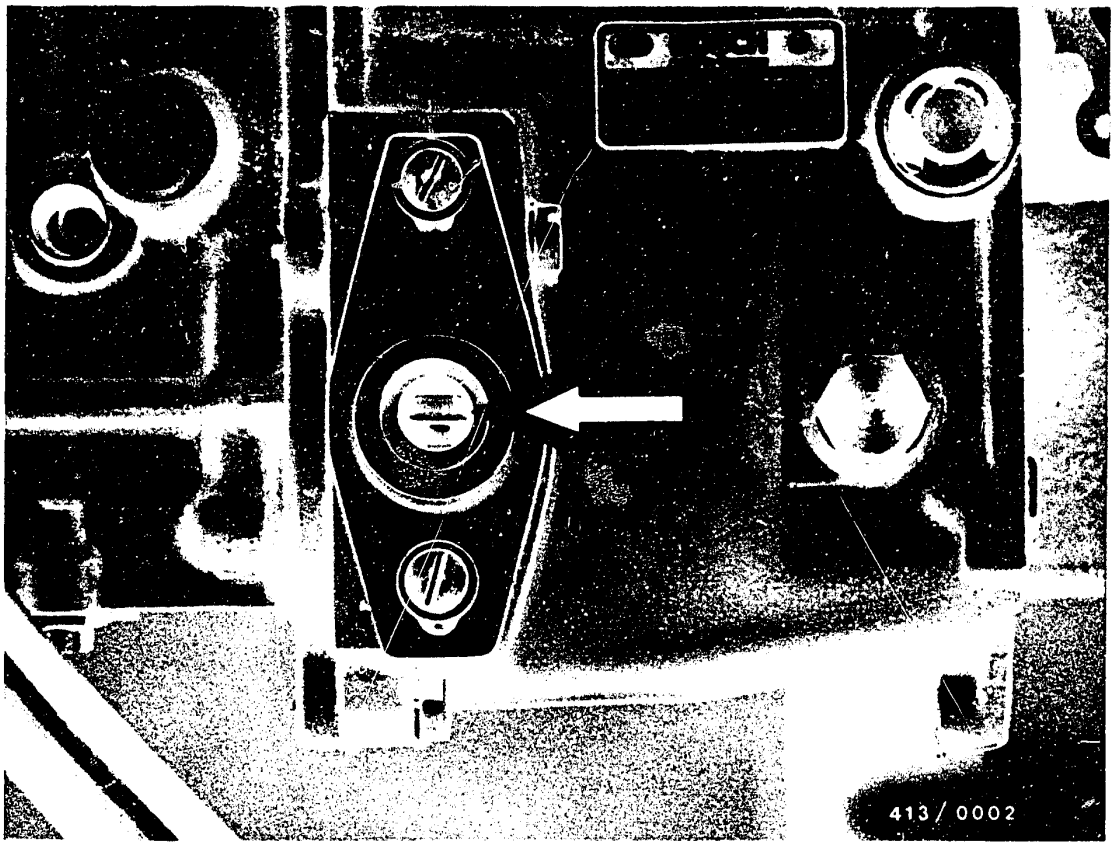
Before installing the fuel-injection pump, check whether the connecting rod (5) is correctly adjusted. To do this, press the control lever (1) onto the full-load stop (2). The operating lever (8) must have approx. 0.5 mm play before the full-load stop on the vacuum-control valve (6).

Correction:

Adjust connecting rod (5) with adjustable ball head (4).



Remove support bracket (1) from the injection pump which has been removed, and screw onto the injection pump which is to be installed.
Do not tighten fastening screw (2) so that it is still possible to make an adjustment within the slot.



Fuel-injection pumps with start-of-delivery sensor system (FBG)

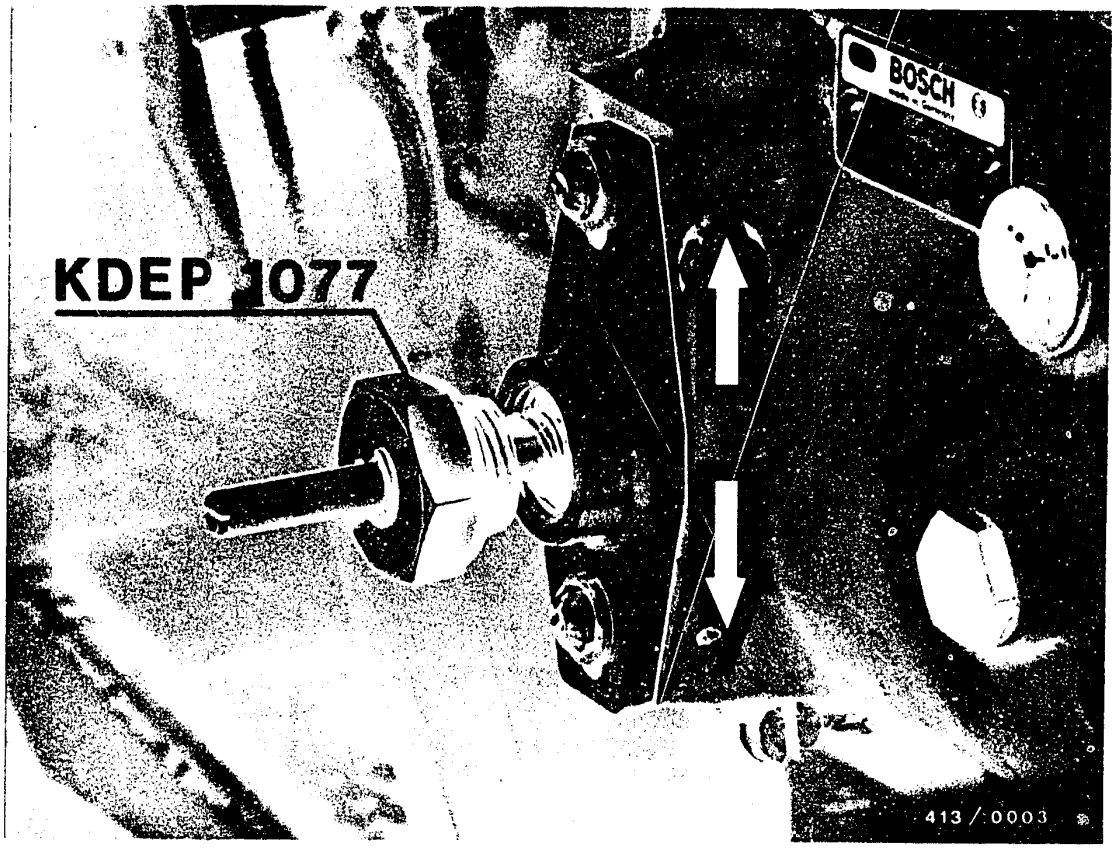
Preparing the injection pump:

Remove screw plug from sliding flange (already removed in the picture).

Do not yet mount injection pump on engine.

Turn injection-pump camshaft with drive coupling until the lug of the governor (arrow) is visible at the sliding flange.

Note:
In this position, the 4th tooth after the tooth gap on the driver points to the line mark on the pump flange.



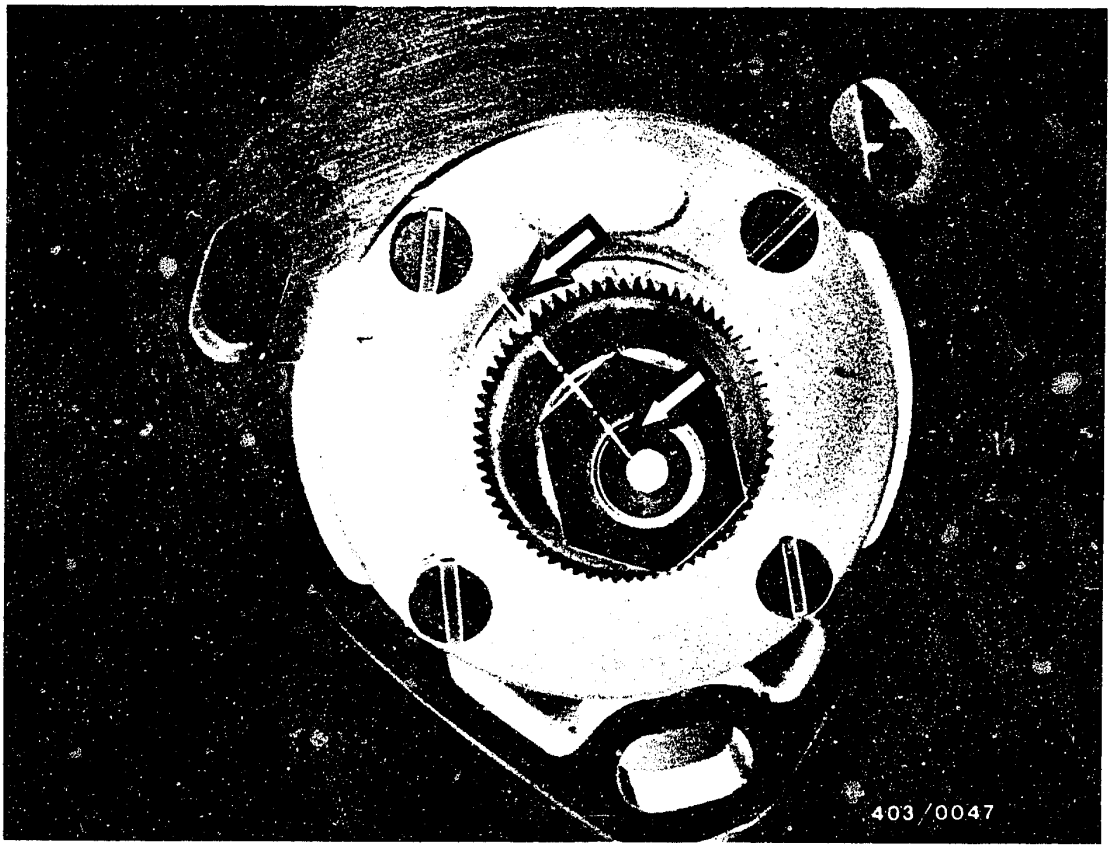
Fuel-injection pumps with start-of-delivery sensor system:

In this position, insert holding device KDEP 1077 until it can be felt to latch.
Finger-tighten nut.
Do not change position of sliding flange (arrows).

Before installing the injection pump, check once again whether the piston of cylinder 1 is at 15° after TDC.

Install the injection pump.

Note: After installing the injection pump, remove the holding device KDEP 1077 immediately.
Injection pump may otherwise be damaged.



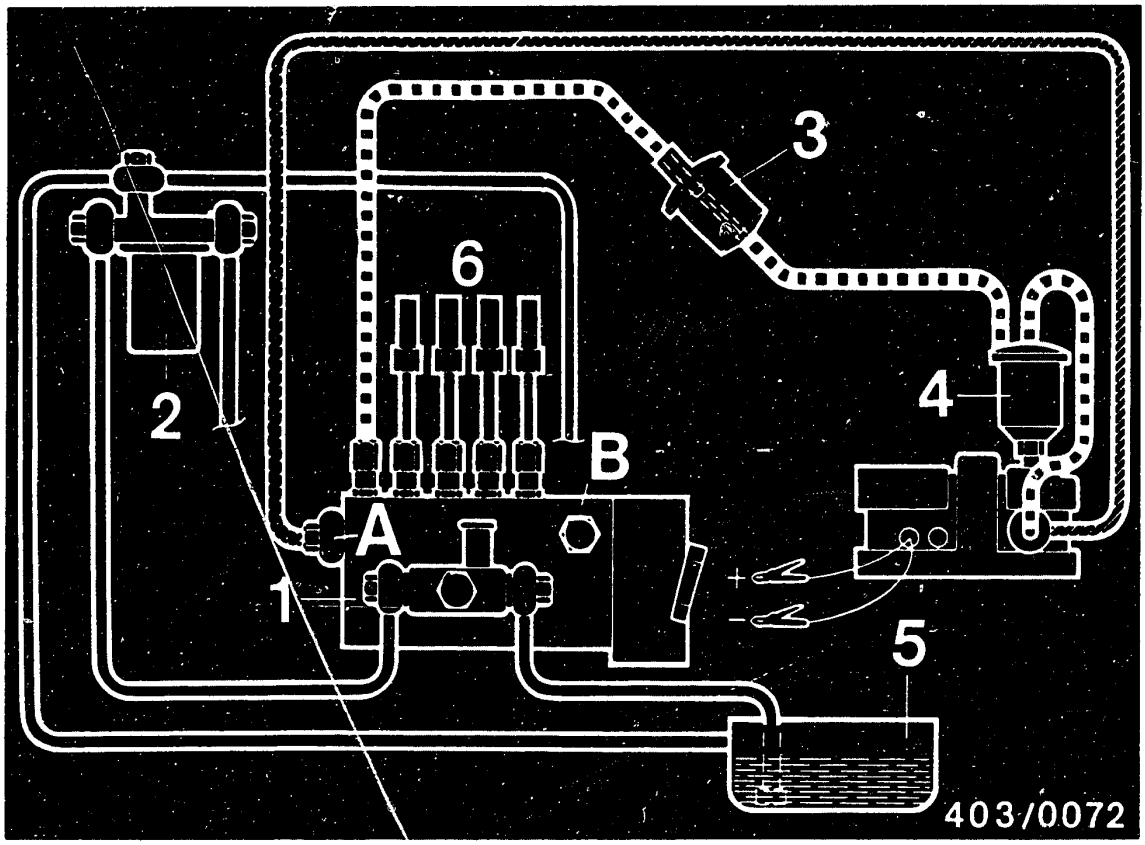
Fuel-injection pumps without start-of-delivery sensor system:

Before installing the injection pump, check once again whether the piston of cylinder 1 is at 24° before TDC on the compression stroke.

Put on new gasket.

Set injection pump to mark.
To do this, turn injection-pump camshaft until the mark on the camshaft aligns with the mark on the flange (arrows).

Slide coupling sleeve onto driver and introduce injection pump so that the pin holes are in the center of the slots.
This makes it possible to pivot the injection pump to either side in order to make a fine adjustment.
Put on plain washers and finger-tighten the injection pump with the fastening nuts.



= Return line
= High pressure approx. 30 + 4 bar

1 = Injection pump
2 = Fuel filter
3 = Sight glass
4 = Start-of-delivery setting device
5 = Fuel tank
6 = Pressure-limiting valves

A = Inlet-union screw, fuel inlet from start-of-delivery setting device
B = Seal fuel return line with screw plug.

26.2 Connection diagram for setting the start of delivery (static)

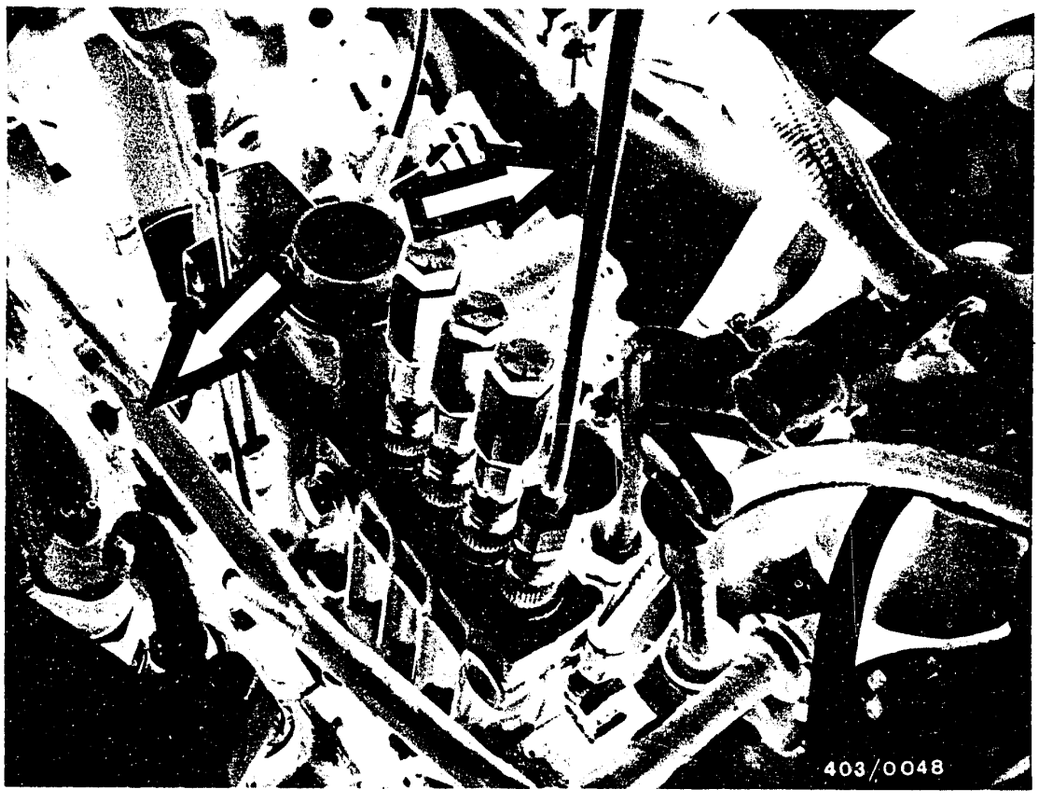
High-pressure overflow method

26.3 Setting the start of delivery

Place setting device next to the vehicle (e.g. on workshop trolley).
Connect high-pressure hose of device to suction gallery inlet of injection pump. Seal return of suction gallery with screw plug.
Screw test line KDEP-P 200/11 on referenced outlet cyl. 1 (for start-of-delivery setting) and plug on pipe bend.
Hang return hose in fuel tank of setting device.
Close the other pump outlets with the pressure-limiting valves KDEP-P 200/13.
Connect electric leads to vehicle battery (12 V) (red cable to +).
Fill fuel tank of device with diesel fuel. Turn engine over one complete time in direction of rotation (2 crankshaft revolutions) and set to start-of-delivery mark 24° before TDC on compression stroke. Switch on start-of-delivery setting device.
Pivot injection pump as far as it will go against the pump direction of rotation.

Caution
Press control lever of injection pump to full load while measuring.

Note:
Switch on start-of-delivery setting device only for measuring. If there are leaking injection nozzles, fuel may otherwise enter the combustion chamber.



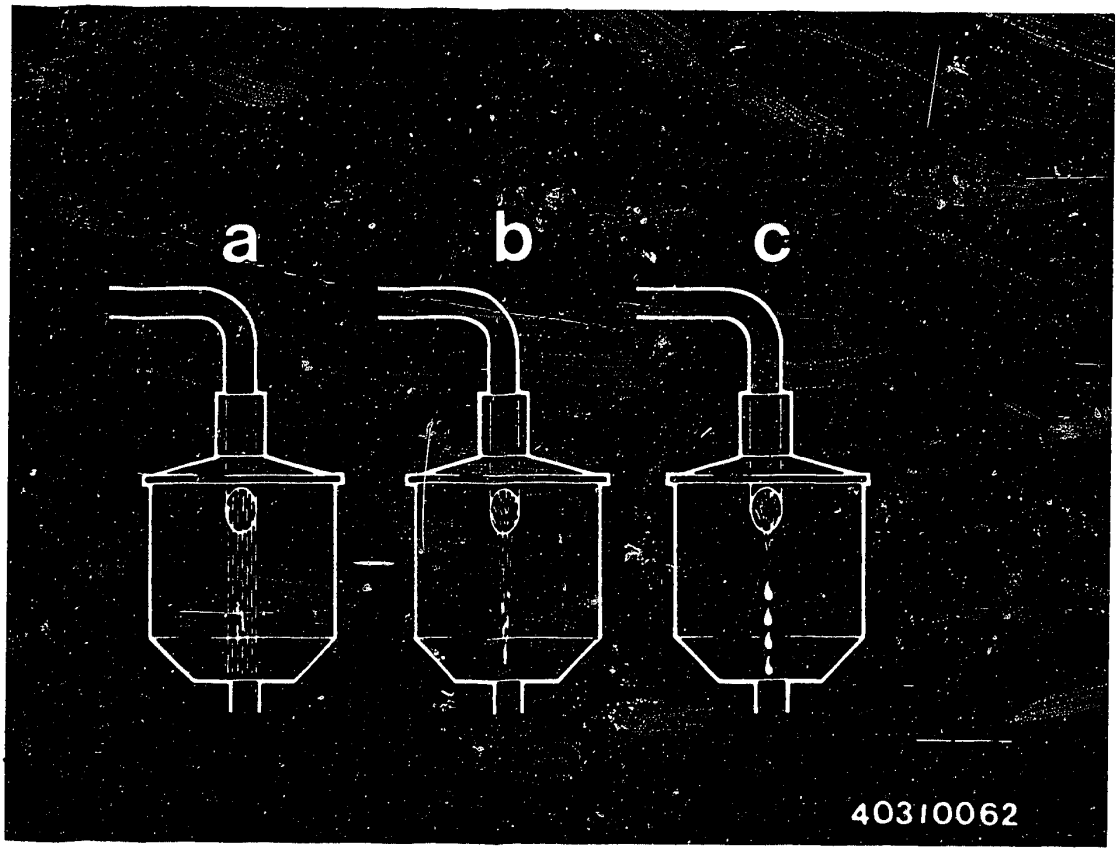
Then pivot the injection pump in the pump direction of rotation until the flow of fuel changes into a chain of drops.

Pivoting the injection pump

Toward the engine = Earlier start of delivery
Away from the engine = Later start of delivery

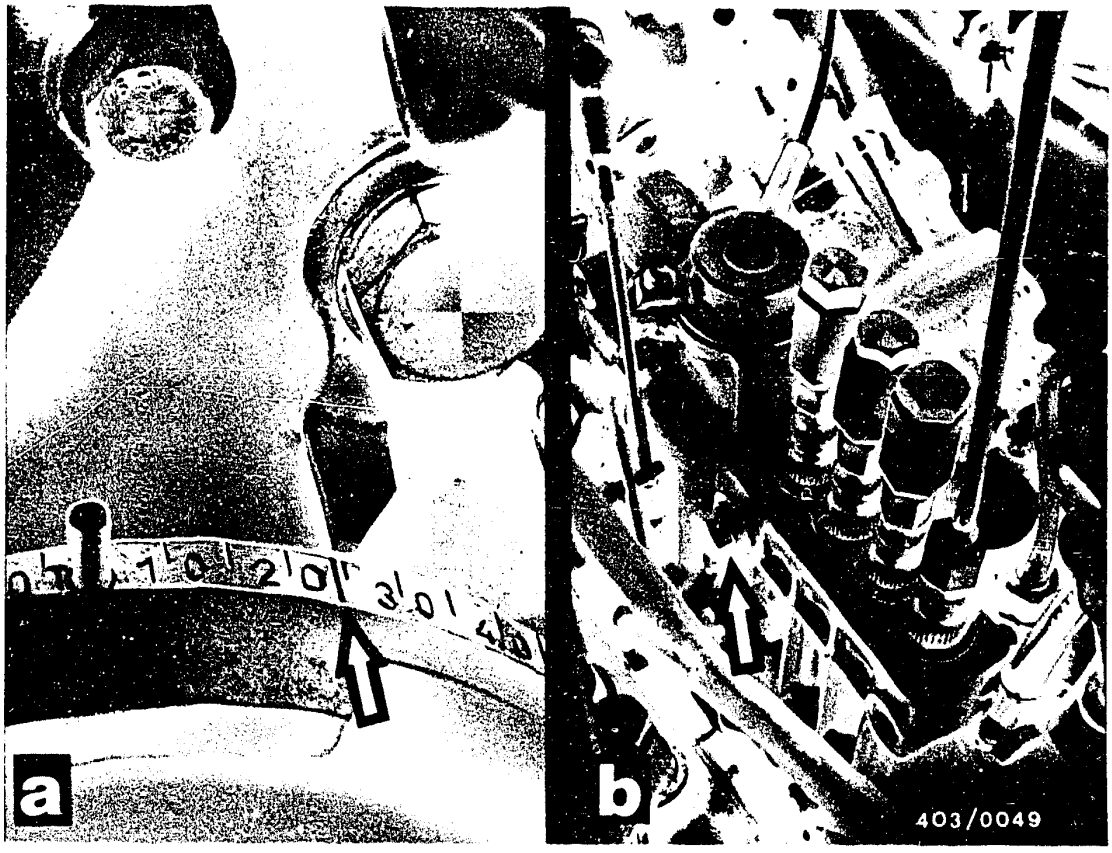
If this adjustment range is not sufficient, the injection pump must be repositioned.
Repeat the check of the start of delivery.

Switch off start-of-delivery setting device.



a = Full fuel spray
b = Contracted fuel spray just before start of delivery
c = Chain of drops at start of delivery

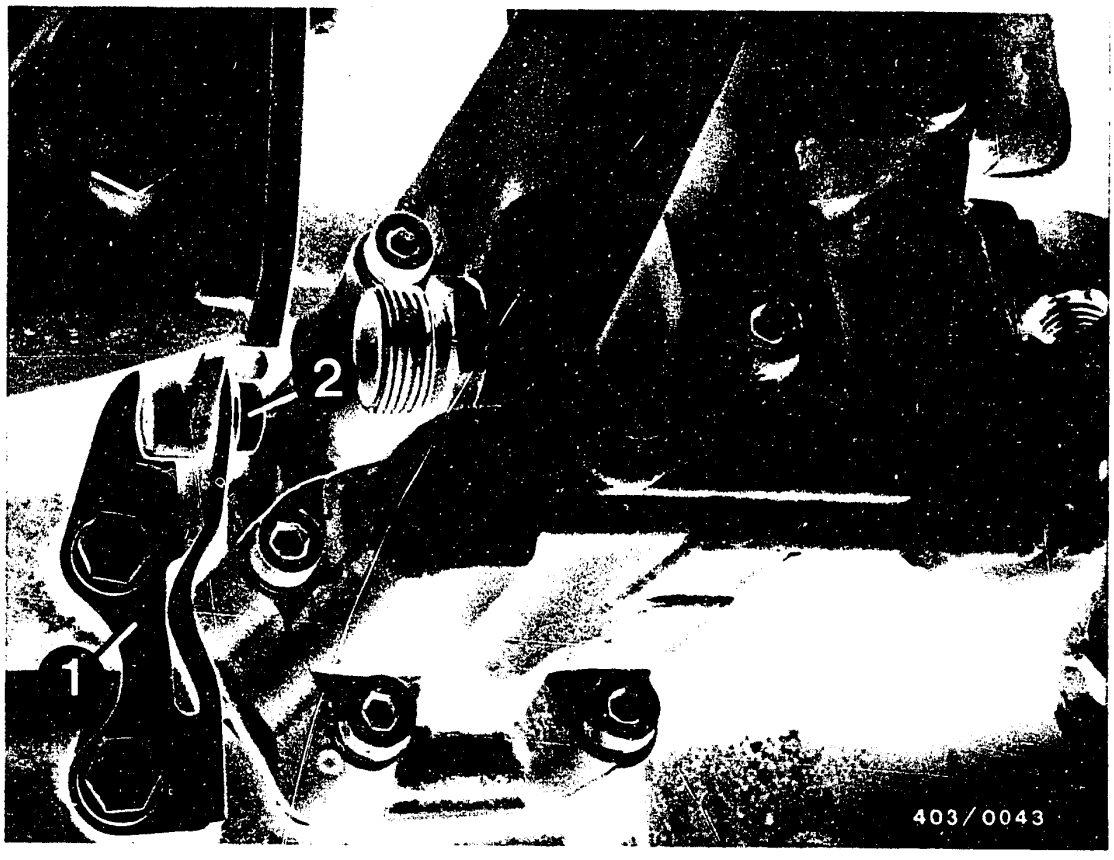
Turn engine over in engine direction of rotation until just before start of delivery.
Switch on start-of-delivery setting device.
Press injection-pump control lever to full load. Turn engine further in direction of rotation. While doing this, observe the flow of fuel at the pipe bend on the injection pump. The start of delivery is reached when the flow of fuel changes into a chain of drops.



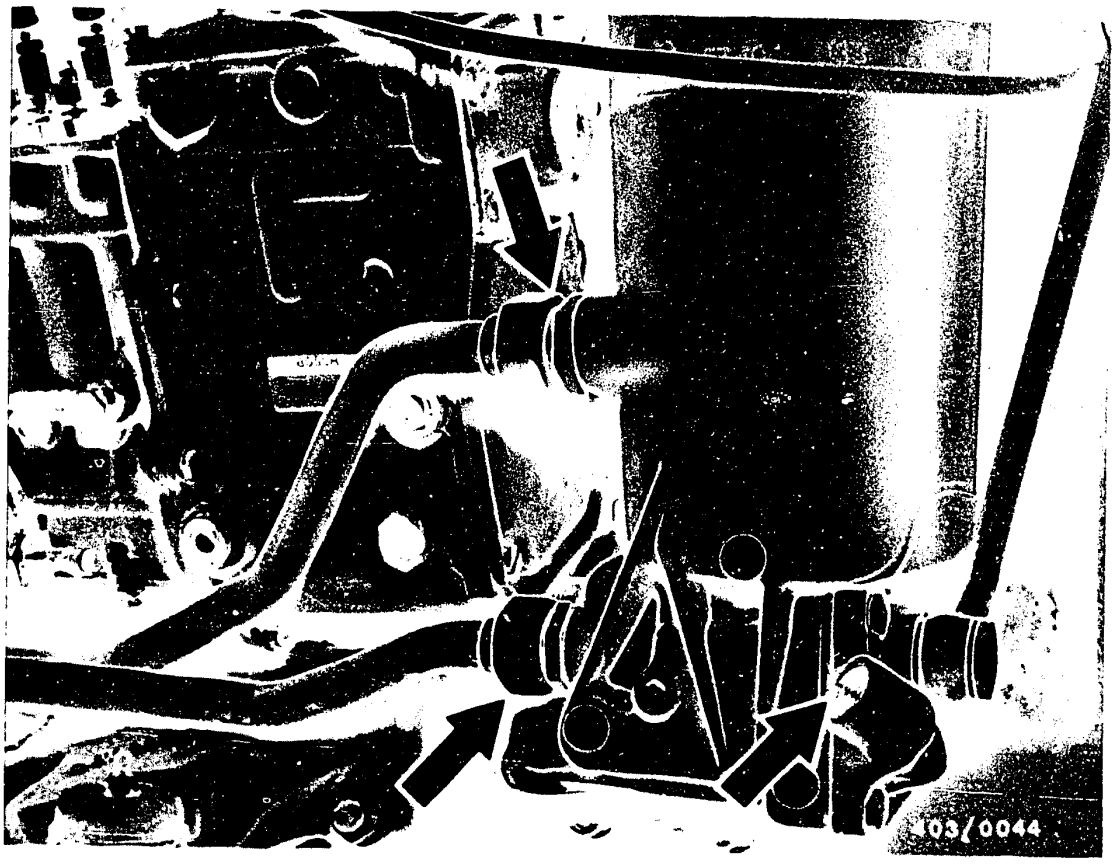
In this position, the engine marks for start of delivery must be in alignment (picture a). Test specification: 24° ± 1° before TDC.
Switch off setting device and remove with accessories.

Remove screw plug (arrow) from return on injection pump and connect return line (picture b).

Mount fuel-injection lines on injection pump.

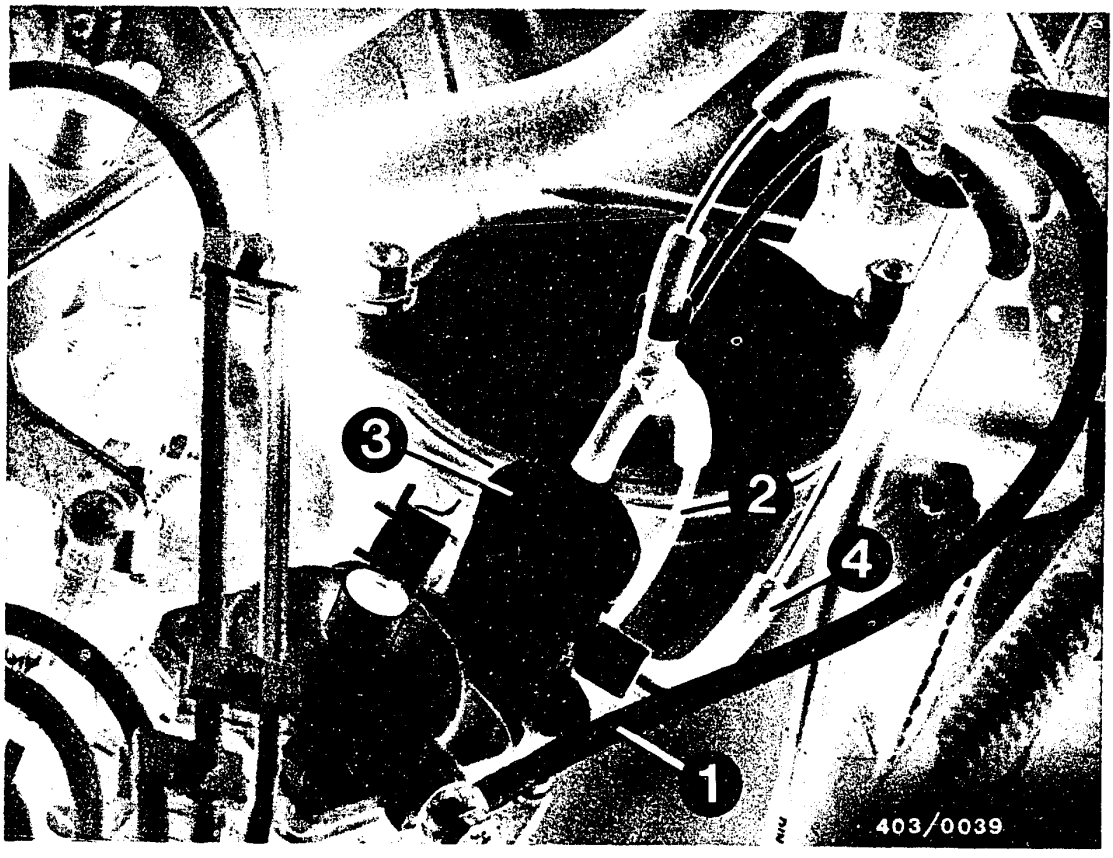


Tighten fastening nuts on injection pump and first of all screw support bracket (1) onto engine block.
Then tighten fastening screw (2) in slot of support bracket.
To fasten the support bracket, use only shim rings Part No. 1 169 901 440 and hexagon screws M8x16.
Screw lubricating-oil line onto injection pump.



Mount oil filter and oil filter cover with new seal.

Connect all oil lines to oil filter.



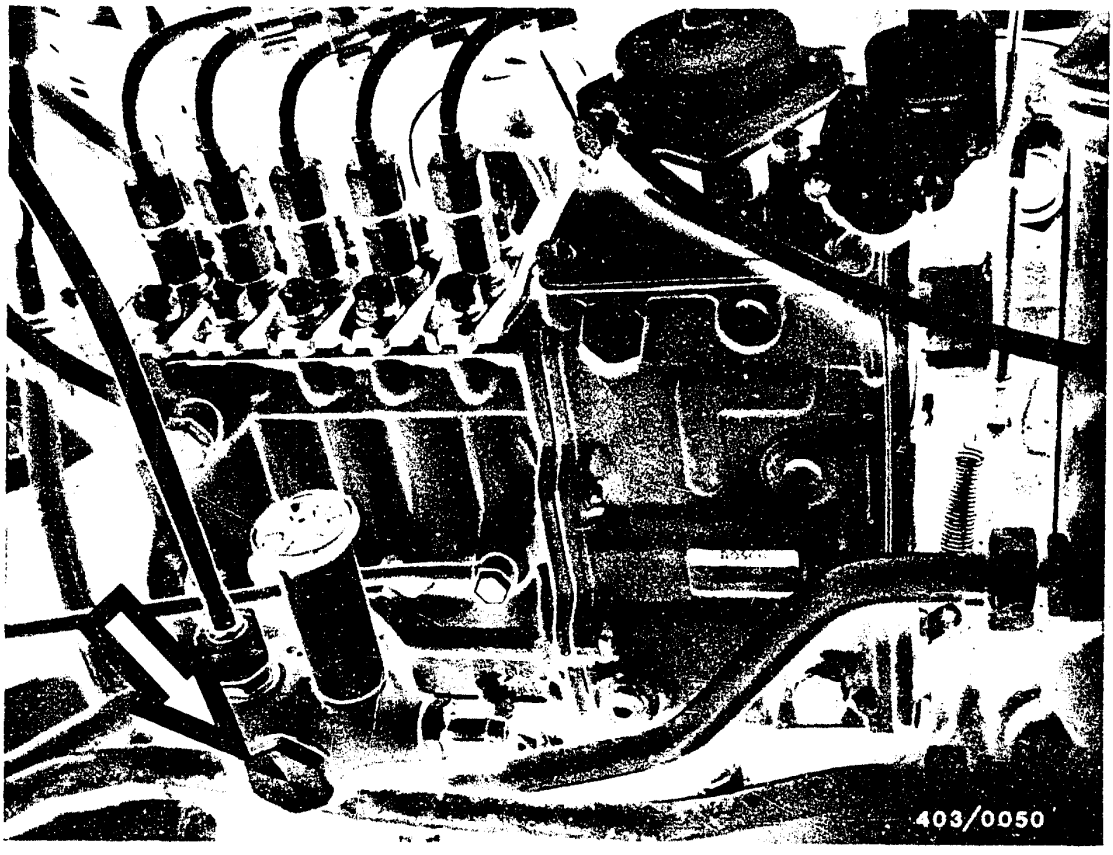
Connect cable for temperature sensor (4).
Connect charge-air pressure line (1) and vacuum line (2) to injection pump as well as fuel lines.

Bleed fuel-injection system with hand primer.

Check accelerator control linkage and adjust.

Bring engine to operating temperature and check all connections for leaks.

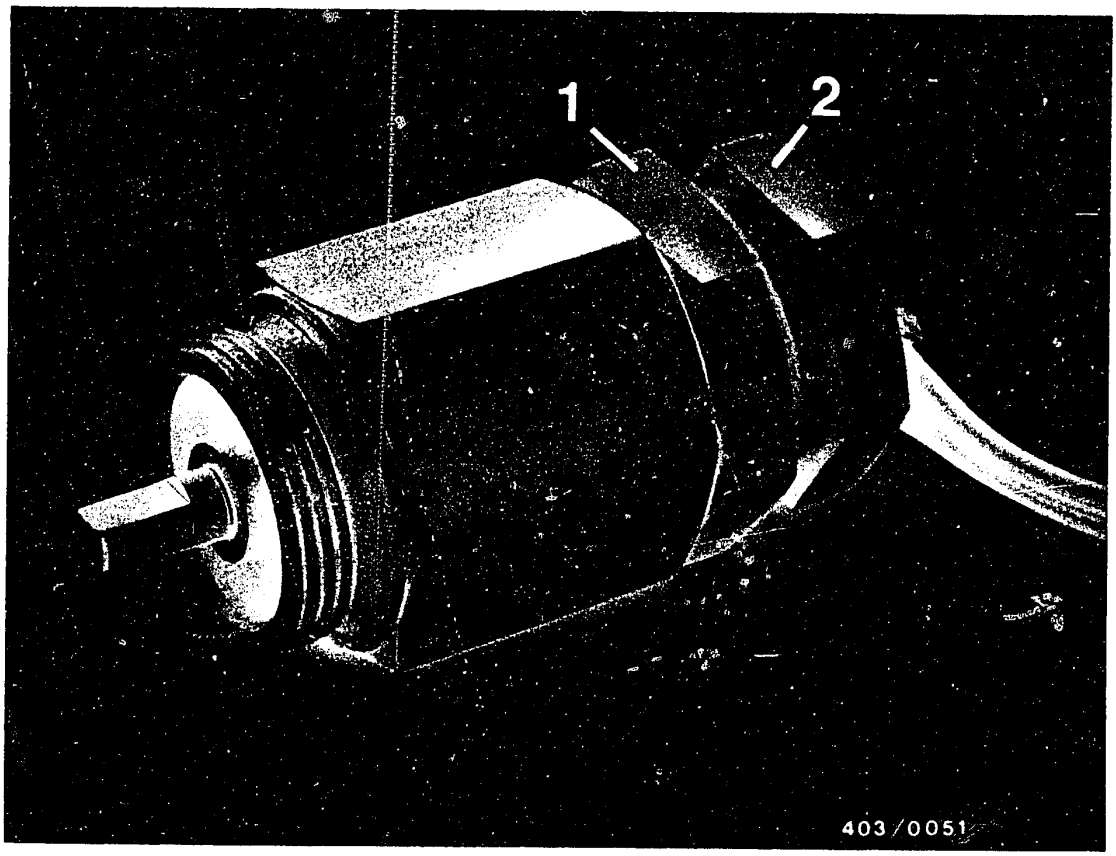
Check idle and adjust.



27. CHECK OPERATION OF TIMING DEVICE

27.1 With contact pickup

The operation of the timing device is checked with contact pickup 1 687 224 556 and contact-triggered stroboscope 0 681 101 104.
Mount contact pickup on supply pump.
To do this, unscrew the screw plug (arrow) on the supply pump.



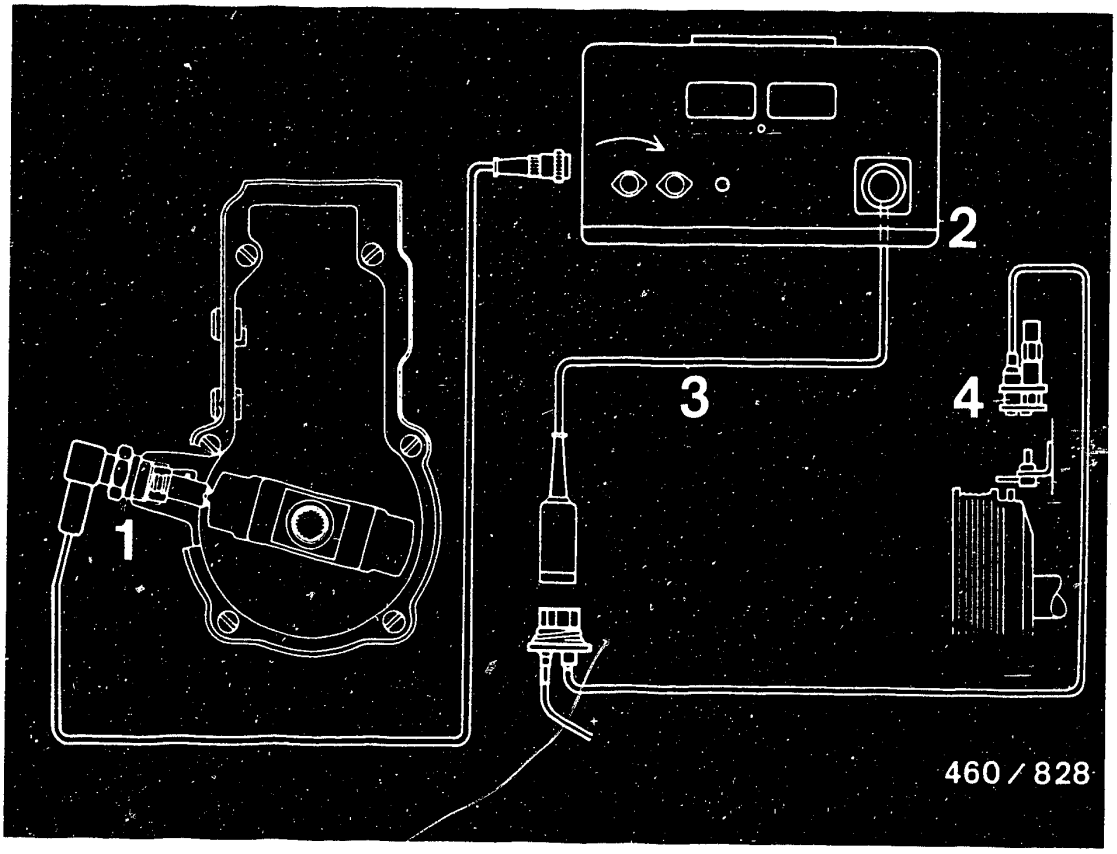
Loosen lock nut (1) on contact pickup and screw back guide part (2).
Screw contact pickup into the supply-pump housing.
Connect contact-triggered stroboscope.
Drive engine and screw in guide part of pickup until the contact-triggered stroboscope flashes regularly.
Tighten lock nut.
Increase engine speed, while at the same time aiming the contact-triggered stroboscope at the graduated disc (flywheel on engine).
The timing advance in degrees must take place briskly and smoothly.
If no timing advance is detectable, remove the timing device.

27.2 With start-of-delivery sensor system

Operating principle:

With increasing engine speed, the governor pulse is advanced by the timing device.
The start-of-delivery measured value becomes smaller and reaches approx. 1° after TDC at maximum advance.

Note: The timing advance in degrees must take place briskly and smoothly.
If no advance is detectable, the timing device is defective.



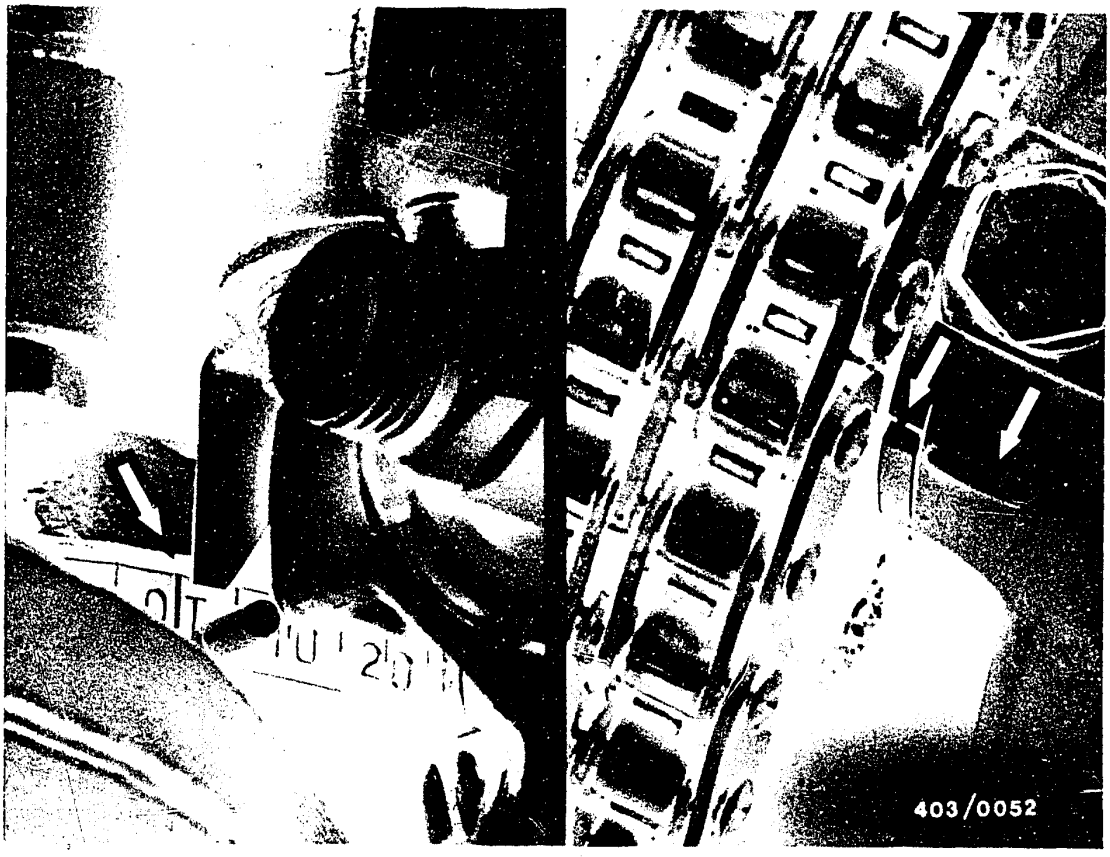
1 = Governor pulse generator, Daimler Benz Part No. 617 589 102 100

2 = Diesel engine tester ETD 019.00, Bosch Part No. 0 684 101 900

3 = Adapter lead, Bosch Part No. 1 684 463 147

4 = TDC pickup (installed in vehicle)

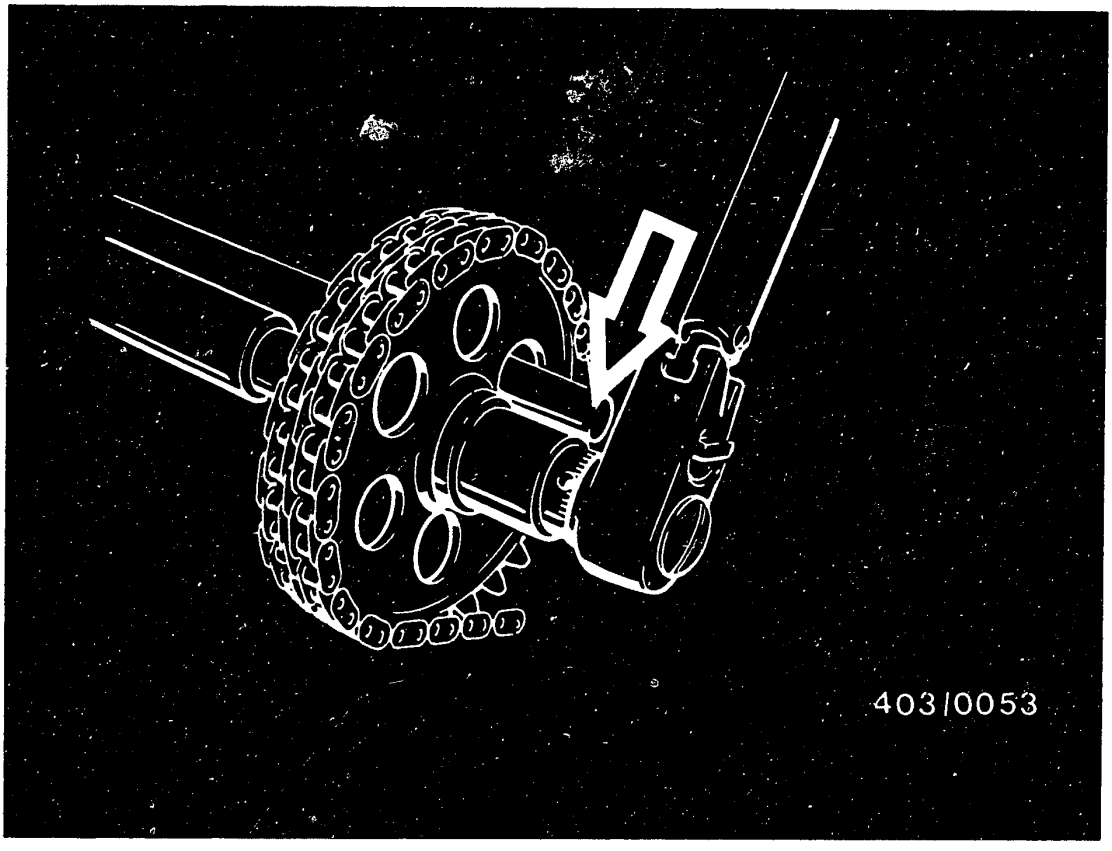
27.3 Connection diagram - check operation of timing device - with diesel engine tester ETD 019.00



28. TEST AND ADJUST ENGINE TIMING

28.1 Test engine timing

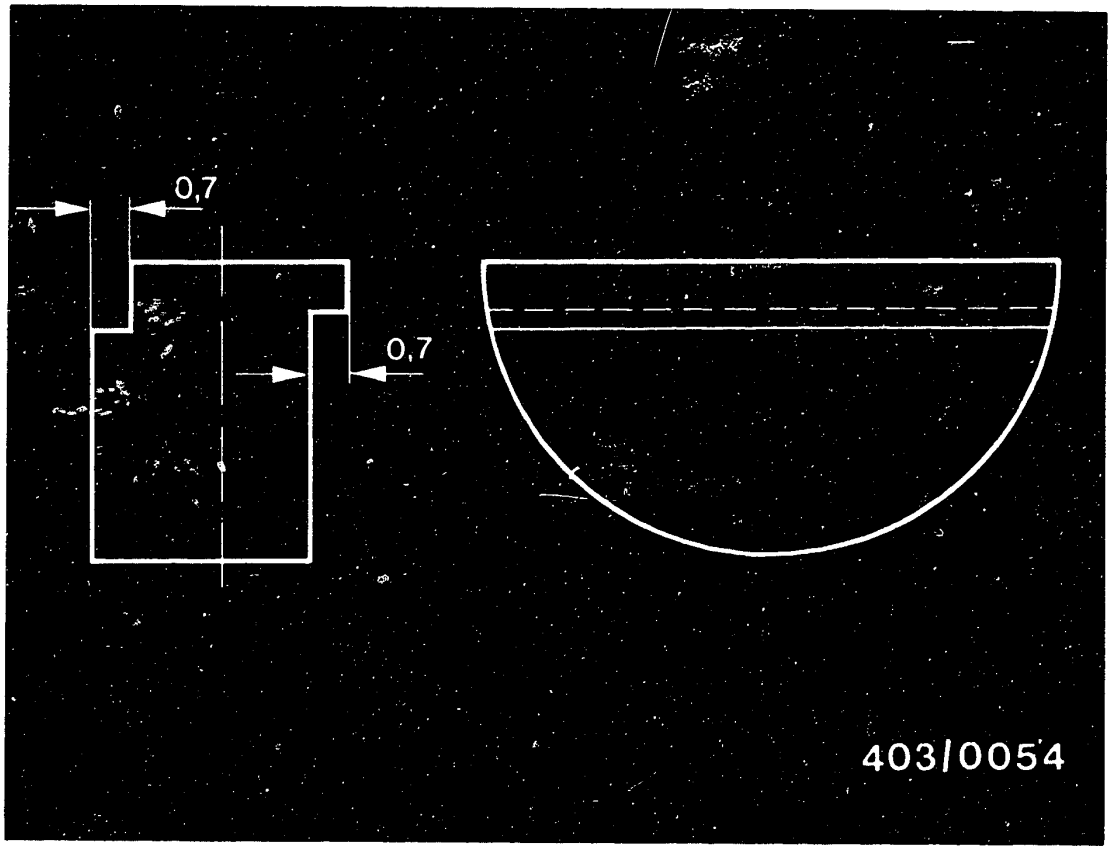
Unhook accelerator control linkage.
Remove cylinder head cover.
Turn crankshaft in engine direction of rotation until cylinder 1 is at TDC mark (left-hand picture).
The marks on the shim and the reference point on the 1st camshaft bearing must be in alignment (right-hand picture).
If the marks are not in alignment, the engine timing must be corrected.



28.2 Adjust engine timing

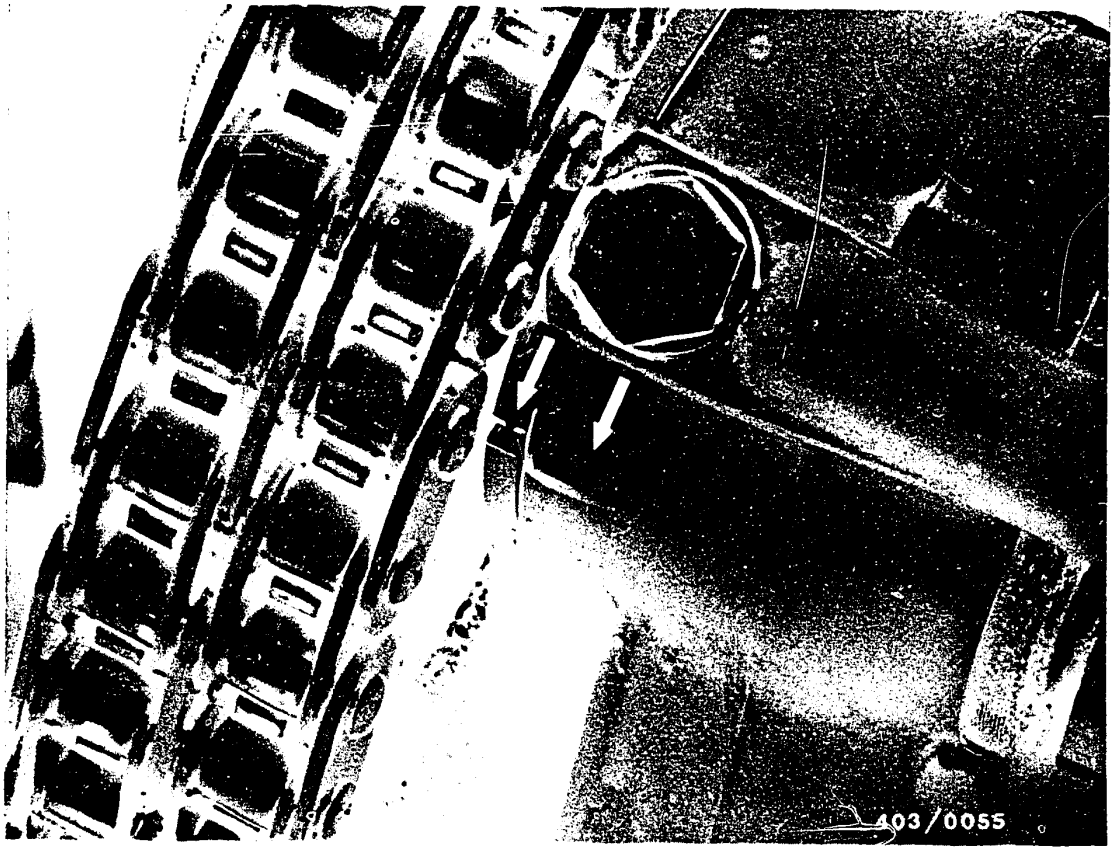
Loosen anti-fatigue bolt for fastening the camshaft gear, but do not screw out.
To loosen, hold the camshaft gear with an auxiliary tool (arrow).

Take off camshaft gear.



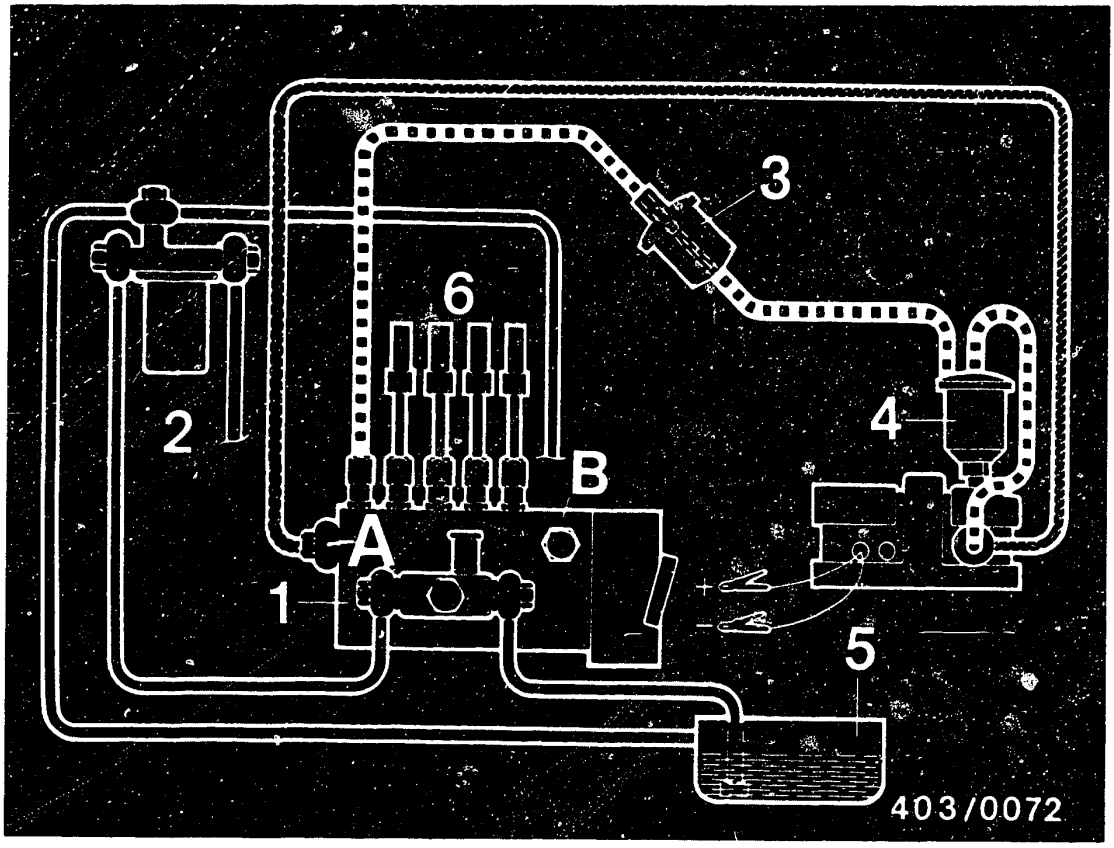
Correct engine timing by changing the Woodruff keys (DB service part).
Graduations of Woodruff keys.

Crankshaft angle	mm	
4°	0.7	(shown)
6.5°	0.9	
8.0°	1.1	
10.0°	1.3	



Slide camshaft gear with chain in position onto camshaft.
Make sure that the mark on the shim aligns with the reference point of the first camshaft bearing (arrow).

Tighten camshaft gear to 80 Nm.
Mount cylinder head cover.
Adjust accelerator control linkage.



= Return line
= High pressure approx. 30 + 4 bar

1 = Injection pump
2 = Fuel filter
3 = Sight glass
4 = Start-of-delivery setting device
5 = Fuel tank
6 = Pressure-limiting valves

A = Inlet-union screw, fuel inlet from start-of-delivery setting device
B = Seal fuel return line with screw plug.

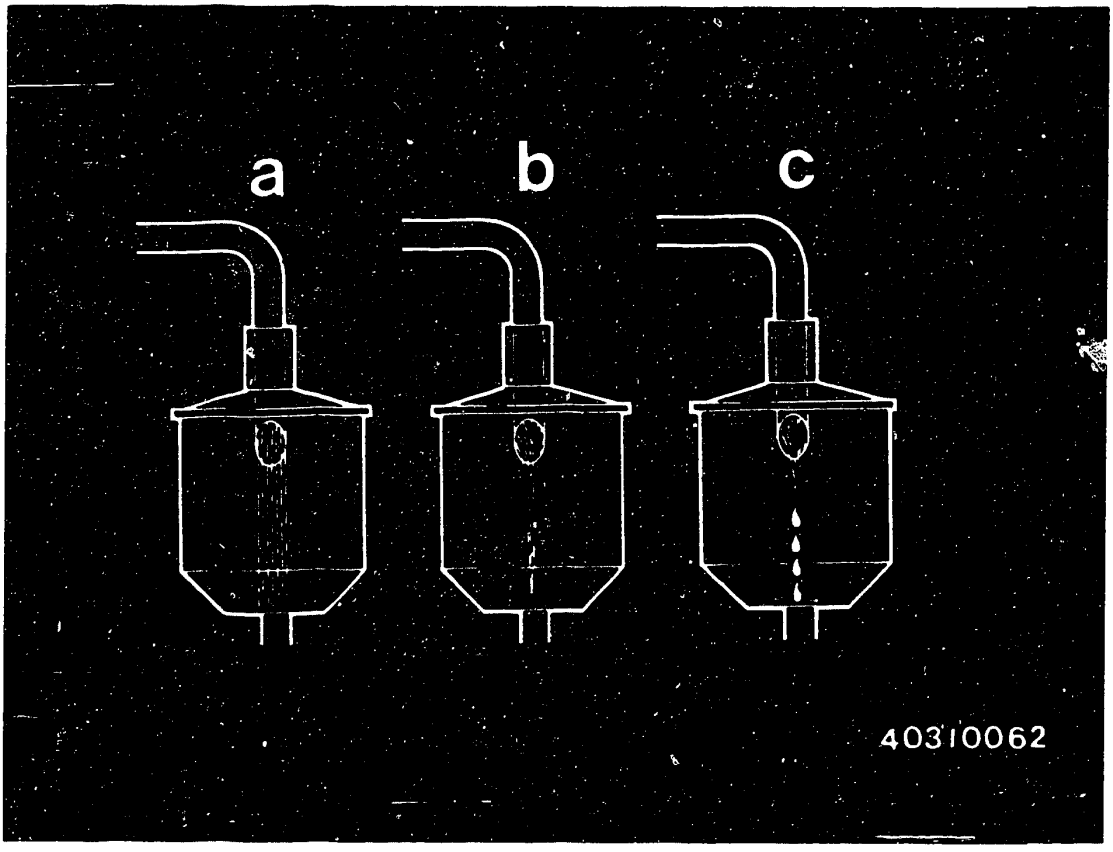
29. TEST INJECTION TIMING

29.1 Static test of start of delivery

Connection diagram for setting the start of delivery
High-pressure overflow method

Remove injection lines from injection pump and nozzle holders.
Set up setting device next to the vehicle (e.g. on workshop trolley).
Connect high-pressure hose of start-of-delivery setting device to suction gallery inlet of injection pump.
Seal return of suction gallery with screw plug.
Screw test line KDEP-P 200/11 onto referenced outlet cyl. 1 (for start-of-delivery setting) and plug on pipe bend.
Hang return hose in fuel tank of setting device.
Connect electric leads to vehicle battery (12 V) (red cable to +).
Fill fuel tank of start-of-delivery setting device with diesel fuel.
Turn engine over completely in engine direction of rotation to just before start of delivery.
Switch on start-of-delivery setting device.

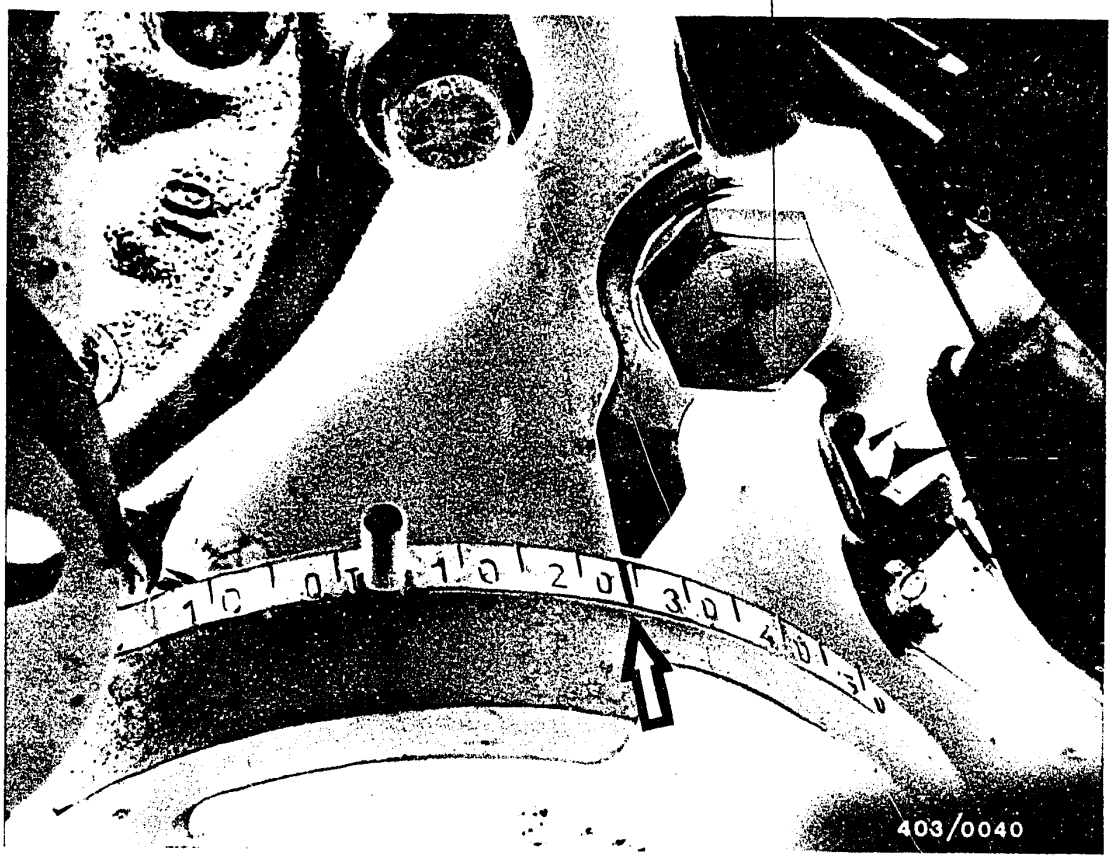
Caution:
Press injection-pump control lever to "full load" while measuring and disconnect vacuum hose from vacuum unit.



a = Full fuel spray
b = Contracted fuel spray just before start of delivery
c = Chain of drops at start of delivery

Note: Switch on the start-of-delivery setting device only for measuring. If injection nozzles are leaking, fuel may otherwise get into the combustion chamber.

Turn crankshaft slowly further in direction of rotation of engine.
While doing this, observe flow of fuel in sight glass.
Start of delivery is reached when the fuel spray changes into a chain of drops.

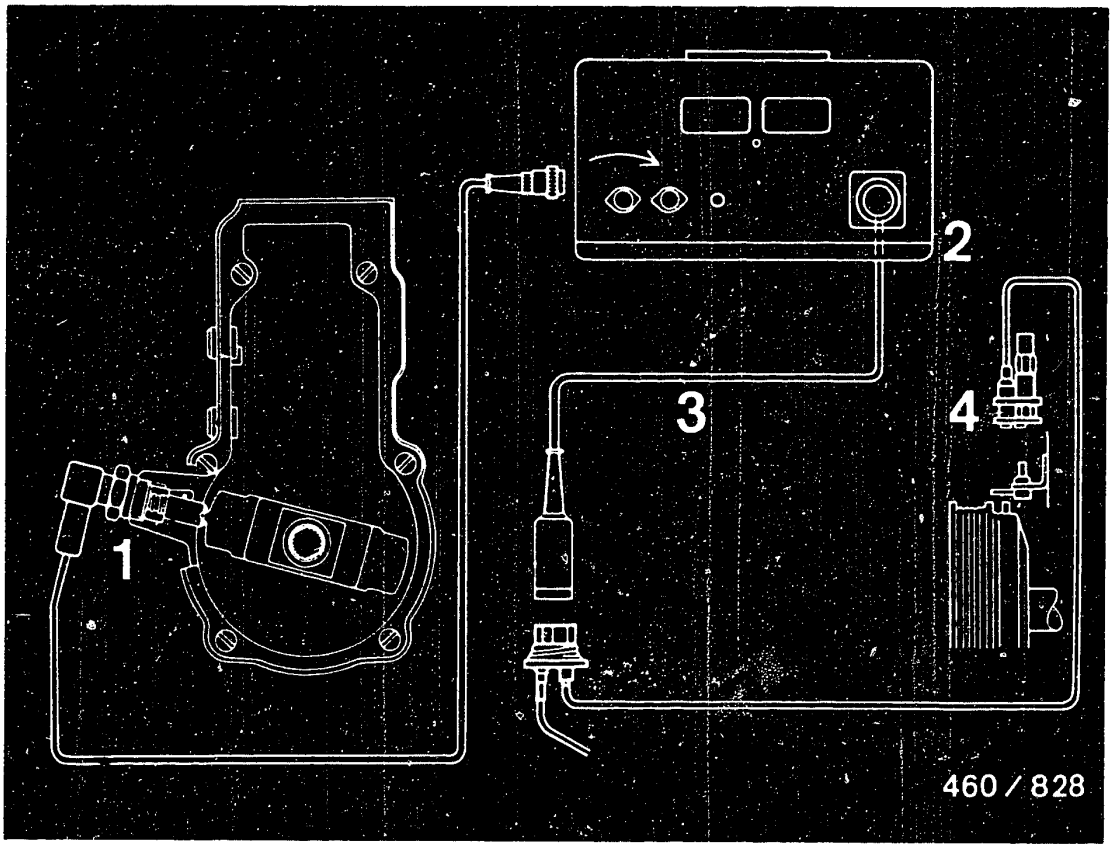


In this position, the engine marks for start of delivery must be in alignment (see picture).

Test specification: 24° ± 1° before TDC

If test specification not obtained, a correction is necessary.
Adjusting:
Turn engine over 2 complete times in direction of rotation and set to start-of-delivery mark 24° before TDC on compression stroke of cylinder 1.
Loosen injection-pump fastening screws.

Pivot injection pump until the flow of fuel in the sight glass changes into a chain of drops.
Pivoting direction:
To the right = start of delivery later
To the left = start of delivery earlier
If the range of adjustment is not sufficient, the injection pump must be repositioned.
Then repeat the check of the start of delivery.
Switch off start-of-delivery setting device and remove accessories. Tighten injection-pump fastening screws (20...25 Nm). Remove screw plug at return of injection pump. Connect return line. Mount injection line on cylinder 1.



1 = Governor pulse generator, Daimler Benz Part No. 617 589 102 100

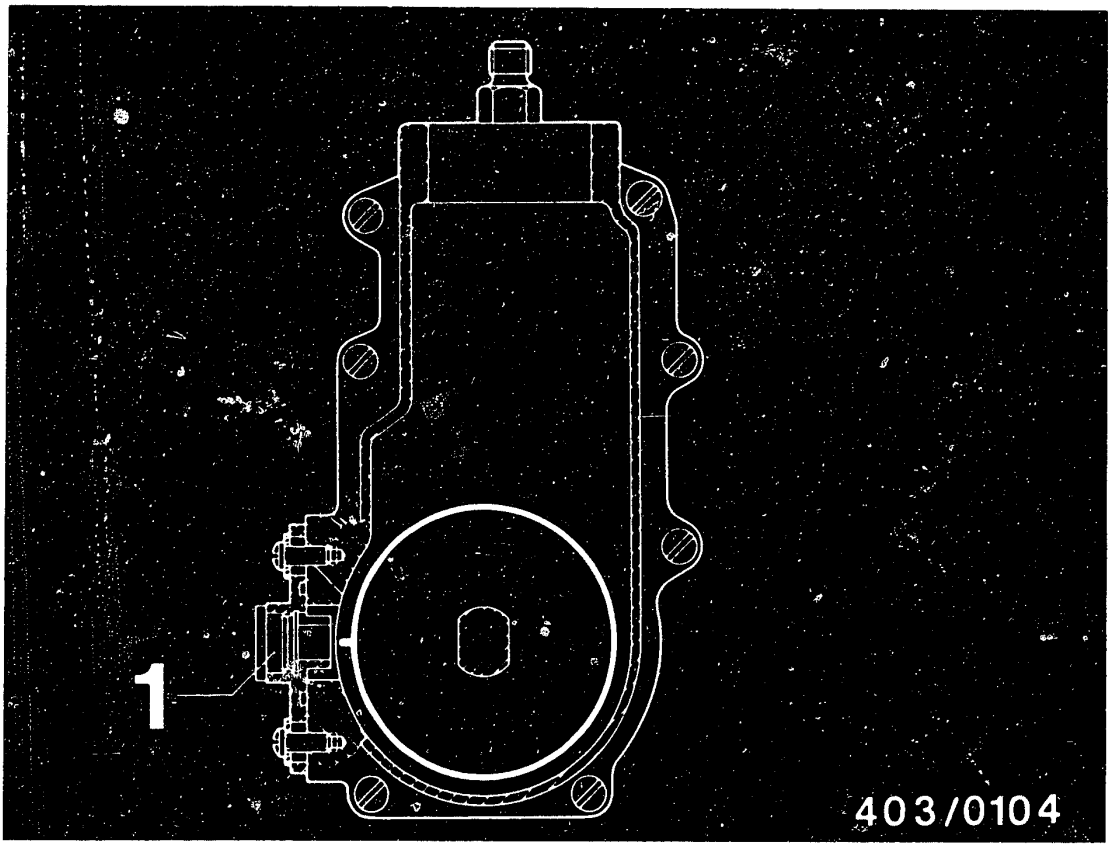
2 = Diesel engine tester ETD 019.00, Bosch Part No. 0 684 101 900

3 = Adapter lead, Bosch Part No. 1 684 463 147

4 = TDC pickup (installed in vehicle)

29.2 Dynamic test of start of delivery

29.2.1 Connection diagram for dynamic testing of start of delivery with diesel engine tester ETD 019.00



Remove screw plug (1) on governor.

Screw in governor pulse generator and connect according to connection diagram.
Run engine at idle speed (750 ± 50 min^{-1}).
Read off governor pulse value on motortester or diesel engine tester.
Test specification: 15° ± 1° after TDC.

If test specification reached, pivot injection pump.

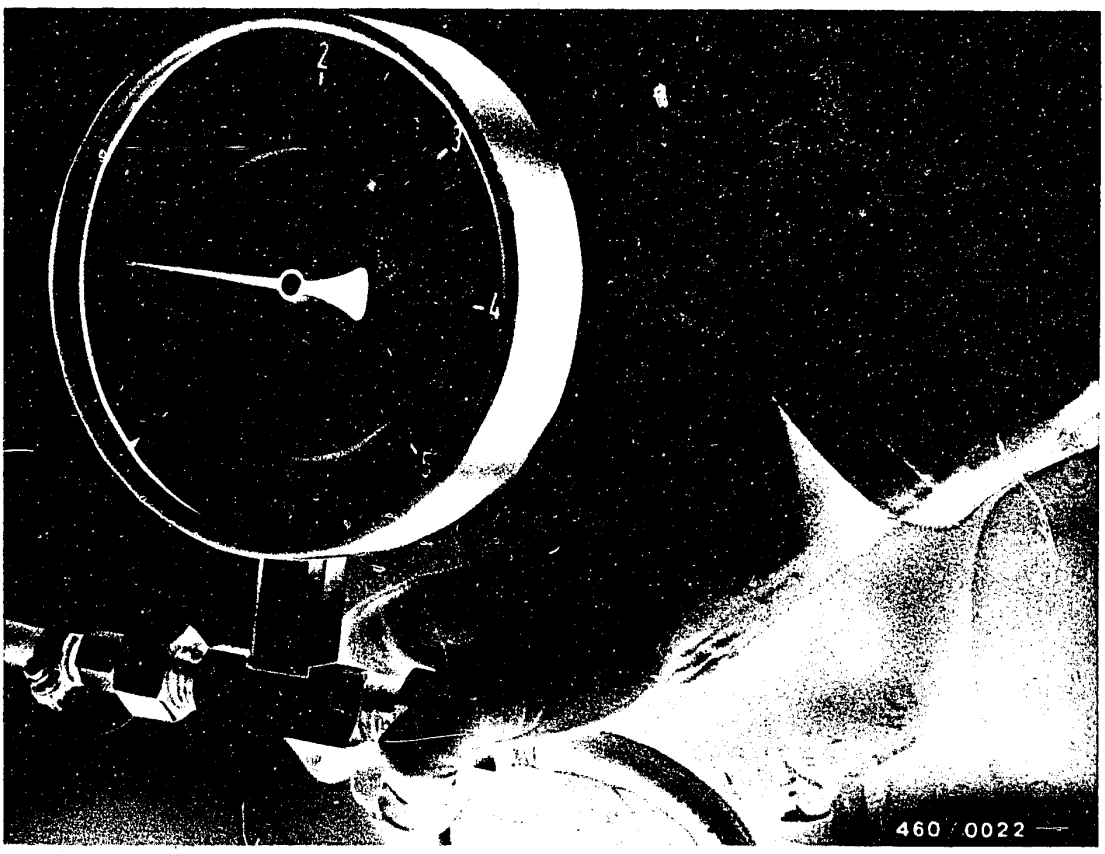
Adjusting:
Loosen injection-pump fastening screws. Mount setting device and holding fork (Daimler-Benz tool no. 617 589 072 100) on pump housing and on cylinder head screws.

Run engine at idle (750 ± 50 min^{-1}).
Adjust injection pump to test specification -15° after TDC by turning the adjusting screw on the setting device.

If the range of adjustment is not sufficient, reposition the injection pump.

Switch off engine. Disconnect tester.
Re-insert screw plug on governor with seal.

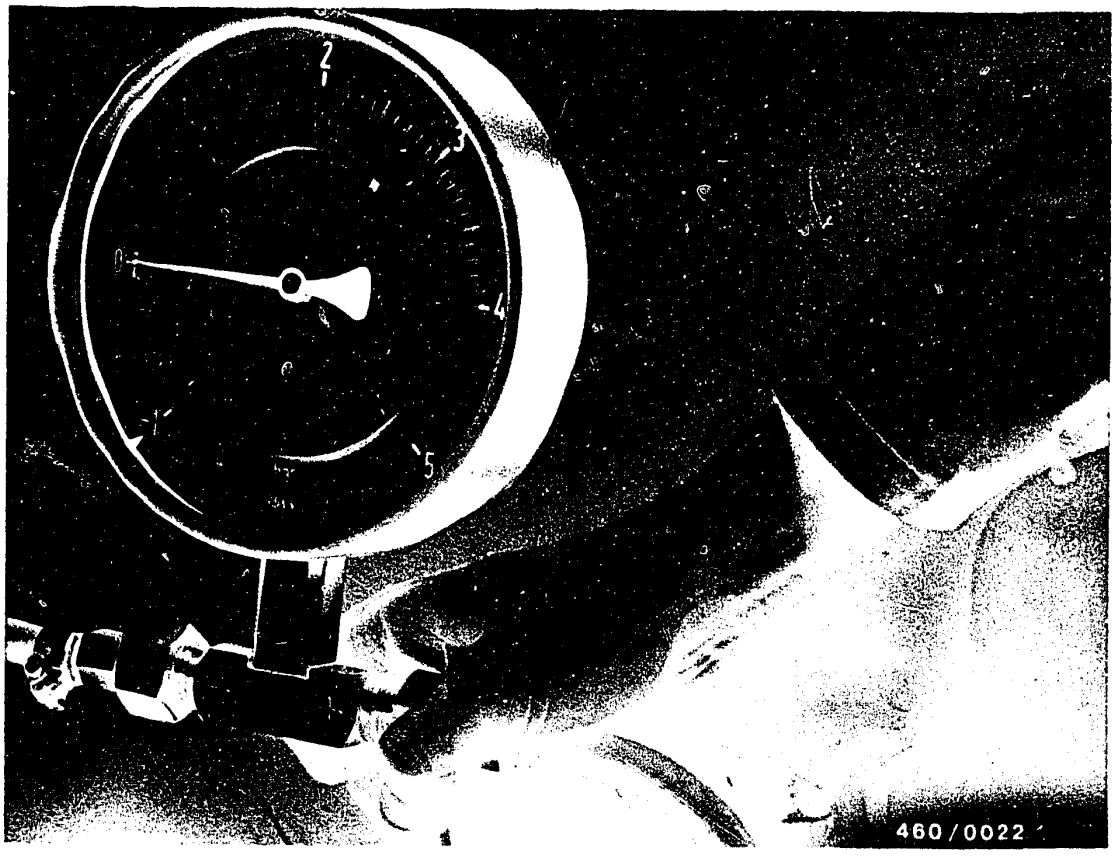
Check engine oil level.



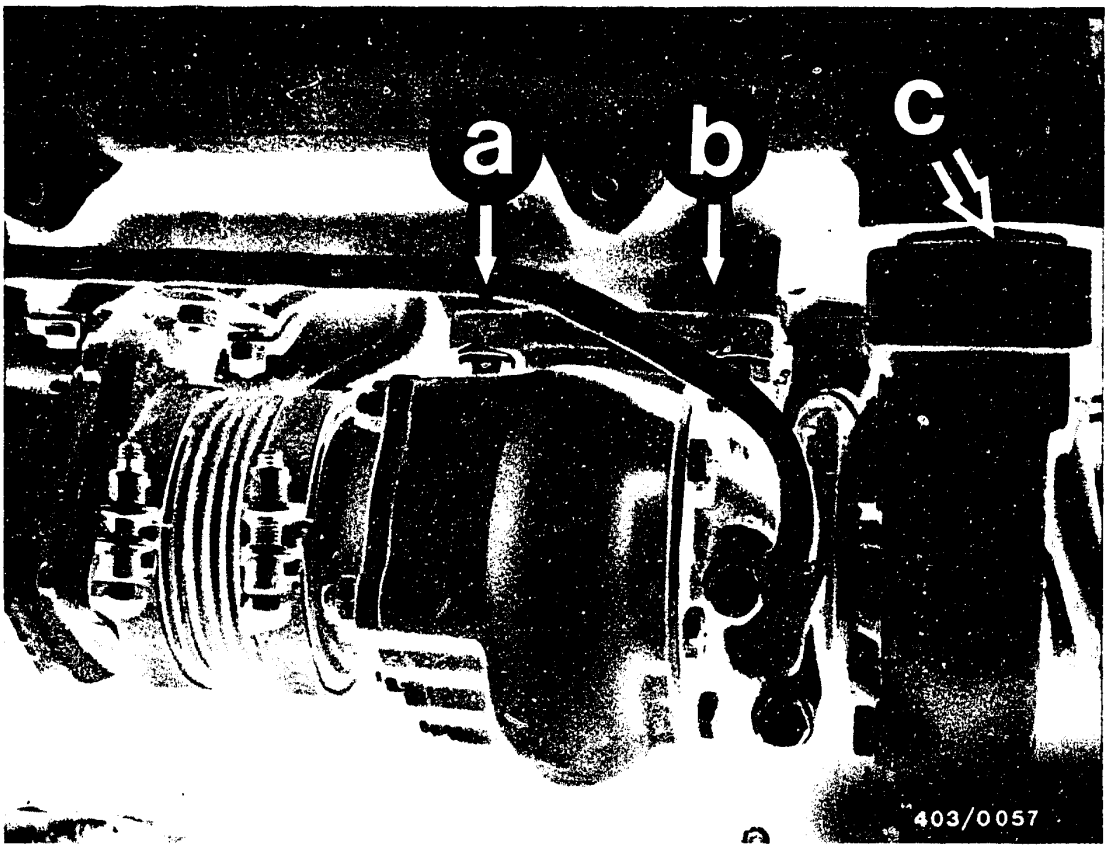
30. TEST CHARGE-AIR PRESSURE

The differential-pressure gauge can be used for testing. Connect the + side of the differential-pressure gauge to the charge-air pipe (to do this, use suitable connection fittings). Test connection thread M 10 x 1.

Note:
To evaluate the exhaust-gas turbocharger, it is essential that the full-load check, maximum speed (unloaded), start of delivery, injection pressure of the injection nozzles as well as the mechanical condition of the engine are O.K.



A charge-air pressure test can be performed only on a chassis dynamometer.
Drive vehicle on chassis dynamometer in drive position "S" at full load and at n = 4000 min^{-1}.
The specified charge-air pressure of 0.7...0.8 bar gauge pressure must be obtained.



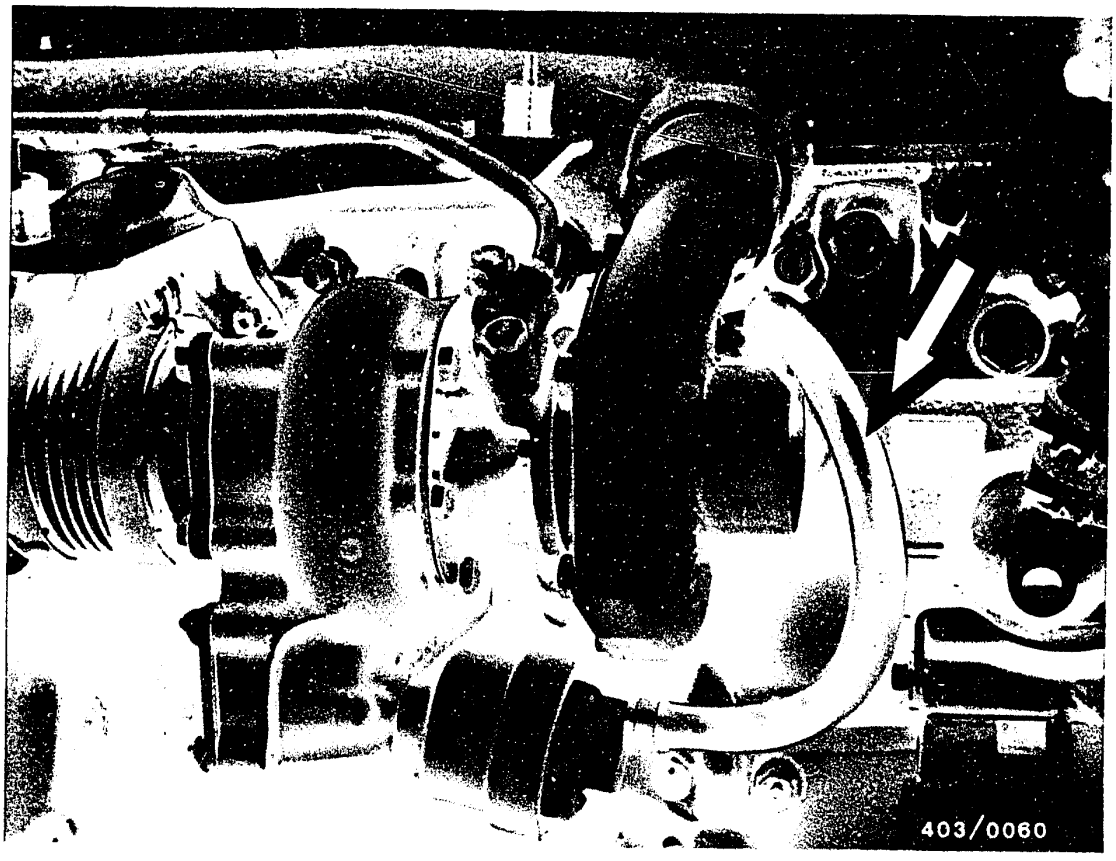
30.1 Check turbocharger for leaks

If incorrect (charge-air pressure too low), perform the following operations:

Clean air filter and check intake air dome for through-flow.

Check turbocharger for leaks. There may be leaks at the following points:

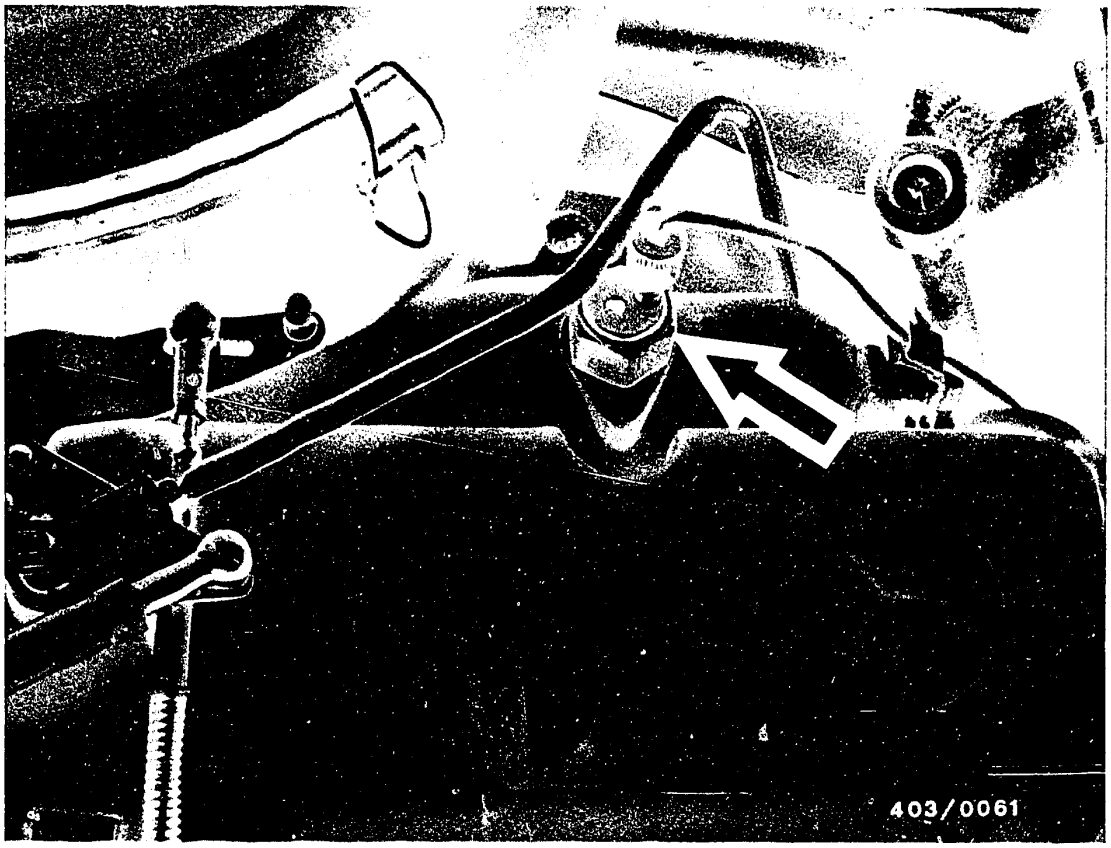
- Flange gasket between exhaust manifold and turbine inlet (a).
- Gasket between compressor outlet and charge-air pipe (b).
- Packing seal between charge-air pipe and exhaust manifold (not visible in picture).
- Pressure line from charge-air pipe to ALDA unit (not visible in picture).



Check charge-air pressure. Test specification 0.7...0.8 bar gauge pressure. If charge-air pressure at full load is greater than 1.1 ± 0.15 bar gauge pressure, perform the following operations:

- Check connecting hose from compressor housing to wastegate (arrow).
  Replace connecting hose if leaking or kinked.

- If the connecting hose is O.K. and the wastegate is not opening, replace the turbocharger.



30.2 Test pressure switch

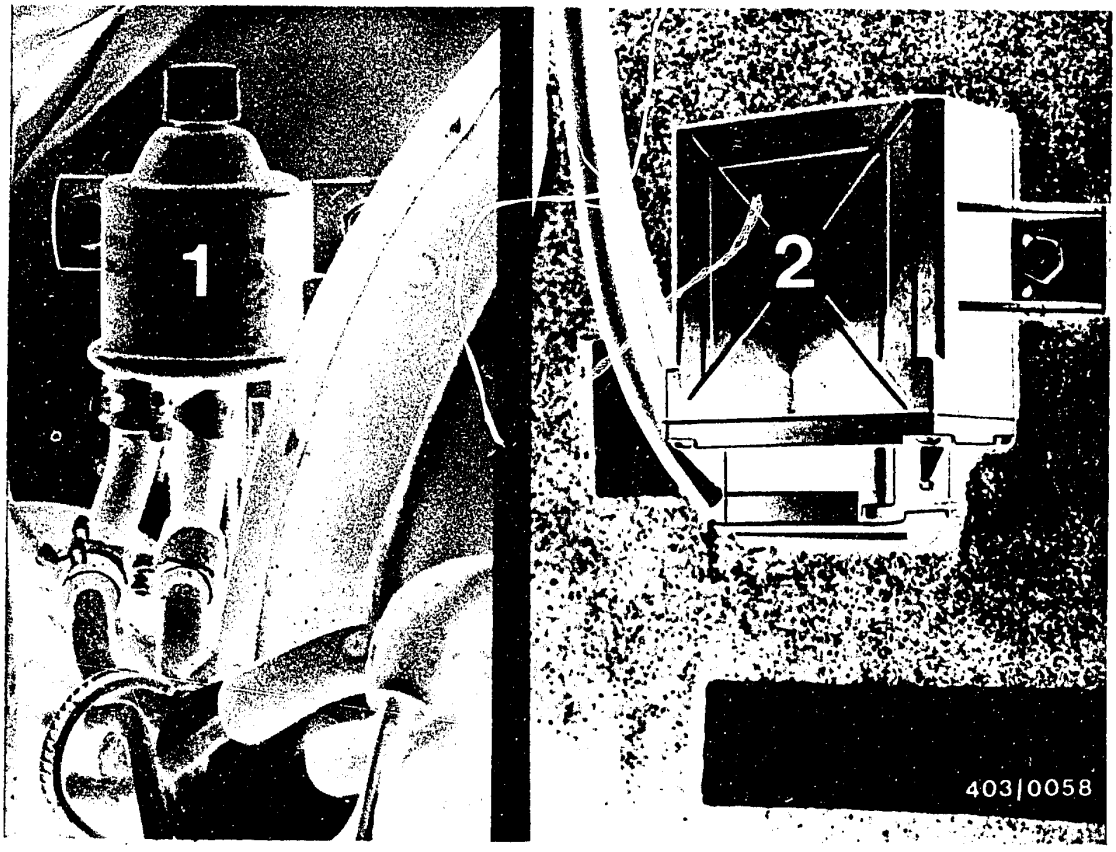
Pressure switch (arrow) on charge-air pipe defective:

Disconnect electrical connection from pressure switch.

Run vehicle on chassis dynamometer or on road.

If engine missing (bucking) no longer occurs, replace pressure switch.

If engine missing still occurs, test change-over valve.

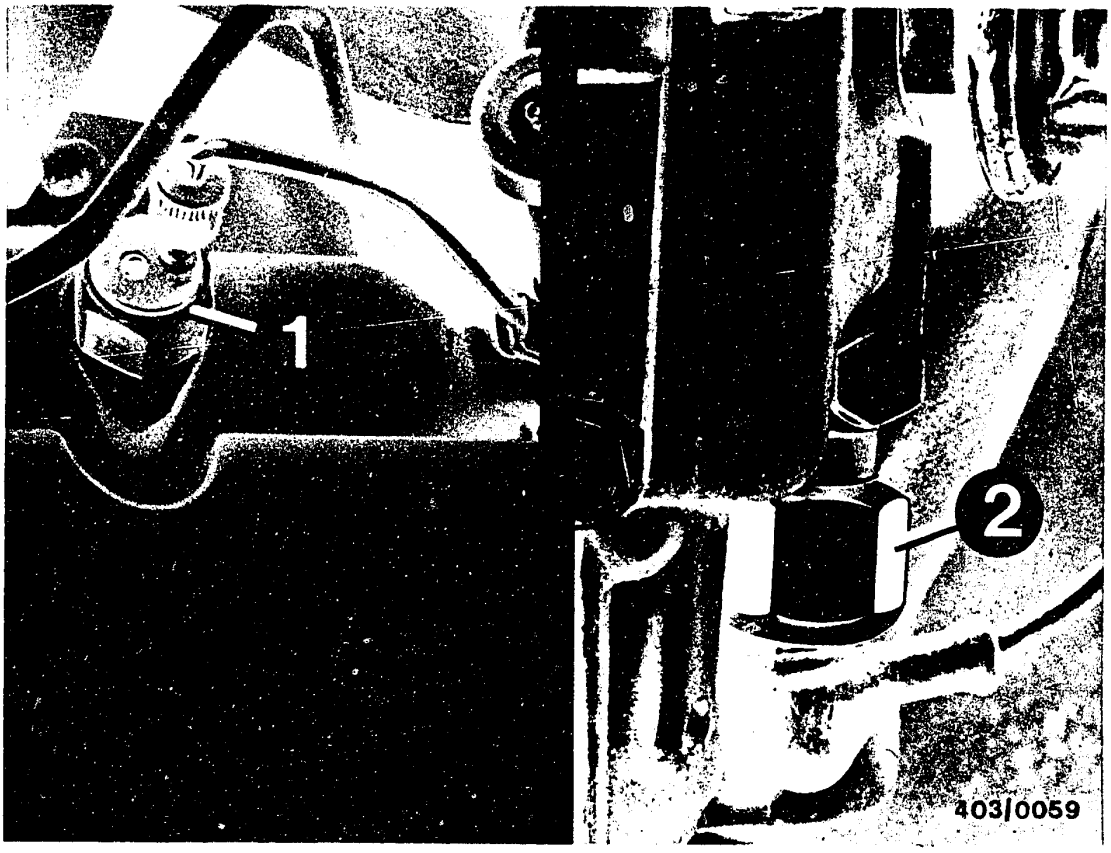


30.3 Test change-over valve

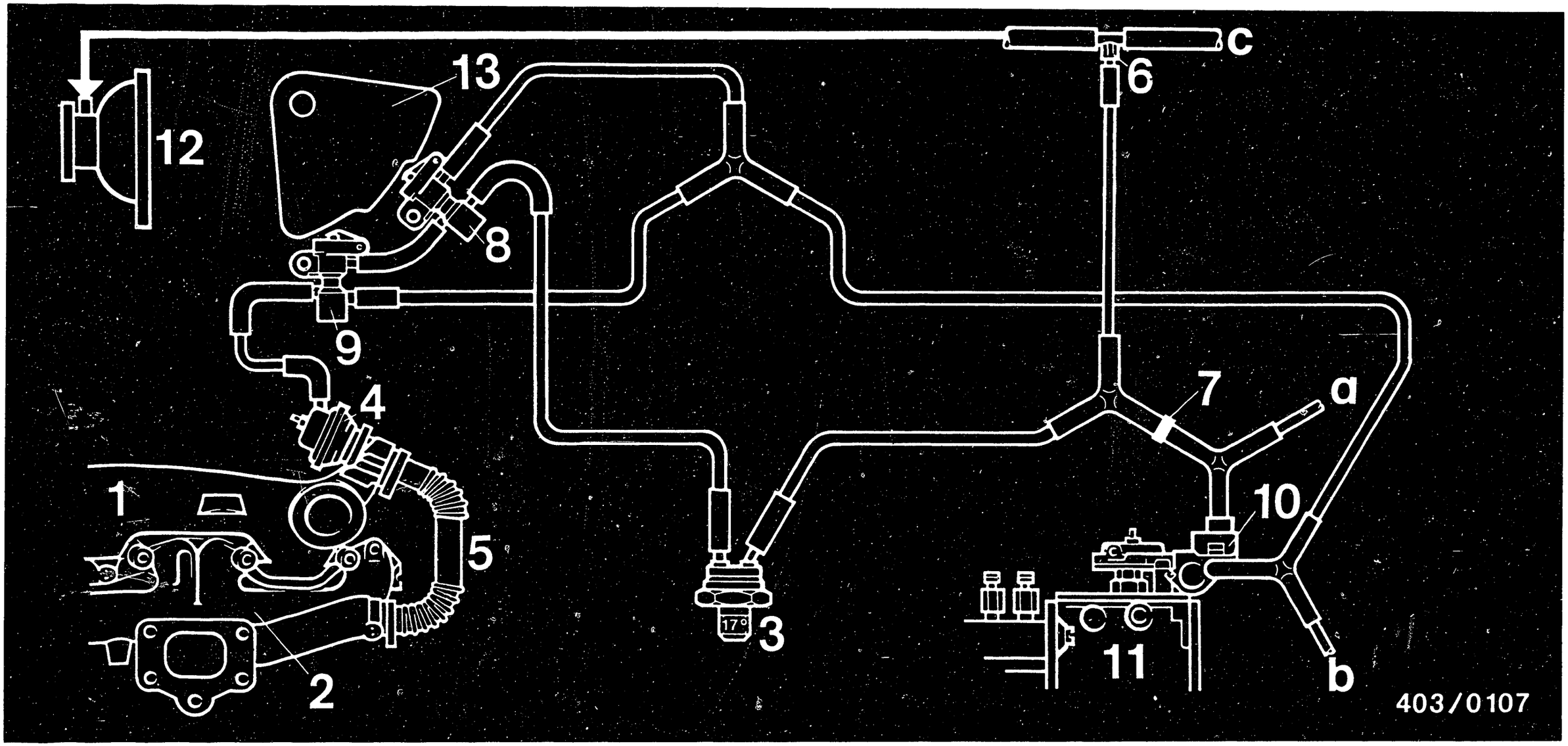
Turn ignition key to position "2". Disconnect connector from change-over valve. Check whether positive voltage is applied to the lead with the color black/red. If positive voltage not present, check fuse no. 4 or lead for open circuit.

At the other lead with the color brown/black, there must be no negative voltage at less than 1.1 ± 0.15 bar gauge pressure in the charge-air pipe.
If negative voltage present, disconnect connector from overload protection control unit (2) and repeat test.

The overload protection control unit is installed under the steering column (up to August 1981 only).



If negative voltage still present, the fault may lie with the pressure switch (1) (1.1 ± 0.15 bar gauge pressure) or at the lead.
If, after disconnecting the connector on the control unit, there is no negative voltage, the fault may lie with the overload protection control unit or with the transmission pressure switch (0.3 bar gauge pressure). The transmission pressure switch is situated on the transmission housing at the speedometer shaft.



1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 17° thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction 0.6 mm
7 = Restriction
8 = Change-over valve - idle cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
a = Automatic transmission
b = Air line to passenger compartment
c = Brake assembly

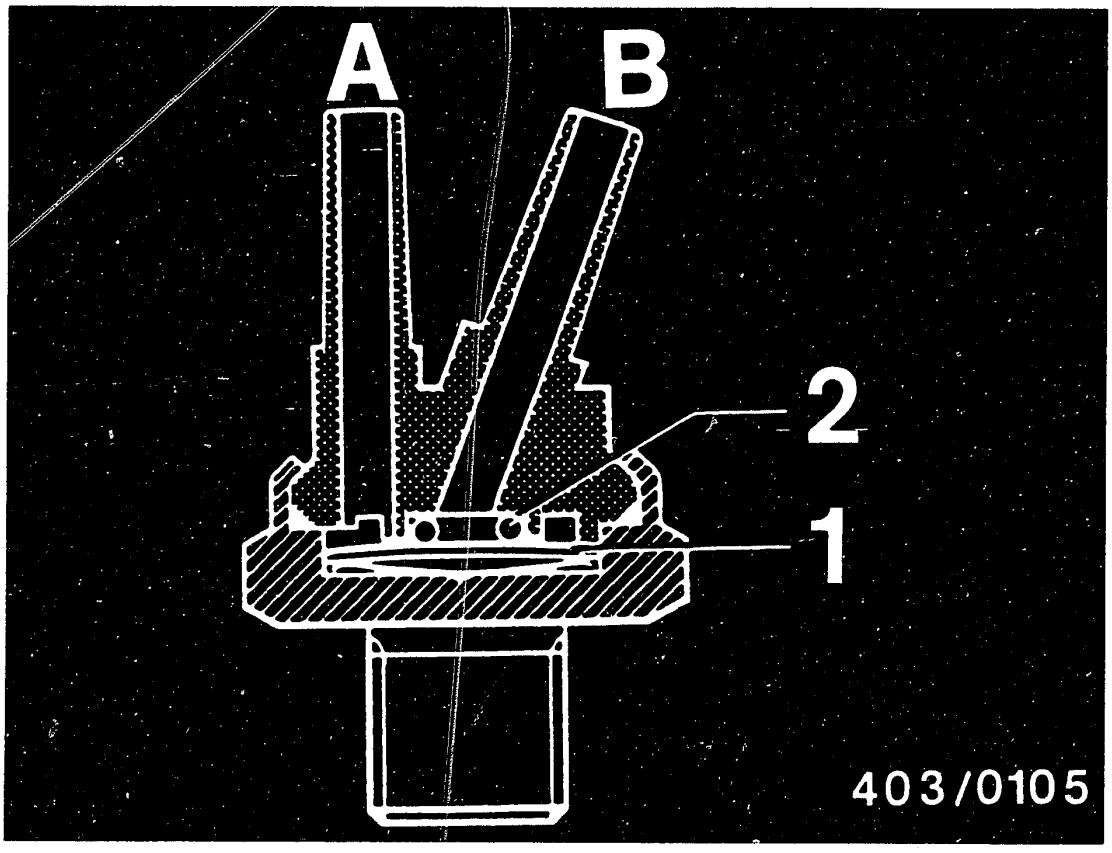
31. TEST EXHAUST-GAS RECIRCULATION SYSTEM (1980 MODEL YEAR)

31.1 Diagram of air lines

31.2 Components of exhaust-gas recirculation and their operating principle

Vacuum tap with restriction

The vacuum tap for controlling the exhaust-gas recirculation system is taken from the vacuum line between vacuum pump and brake assembly.
A restriction (6) of inside diameter 0.6 mm is installed in the tapping point (not replaceable).



1 = Bimetallic plate
2 = O-ring
A = To change-over valve
B = To distributor piece (vacuum)

Thermo-valve +17°C

The thermo-valve is screwed into the thermostat housing.
Below approx. +17°C coolant temperature the bimetallic plate is in contact with the O-ring and closes connection "B". As of approx. +17°C coolant temperature the bimetallic plate moves downward due to heating. Both connection ports are then connected.

The vacuum line to the distributor piece must be connected at connection "B", because only in this way is there the guarantee of complete freedom from leaks between bitmetallic plate and O-ring.

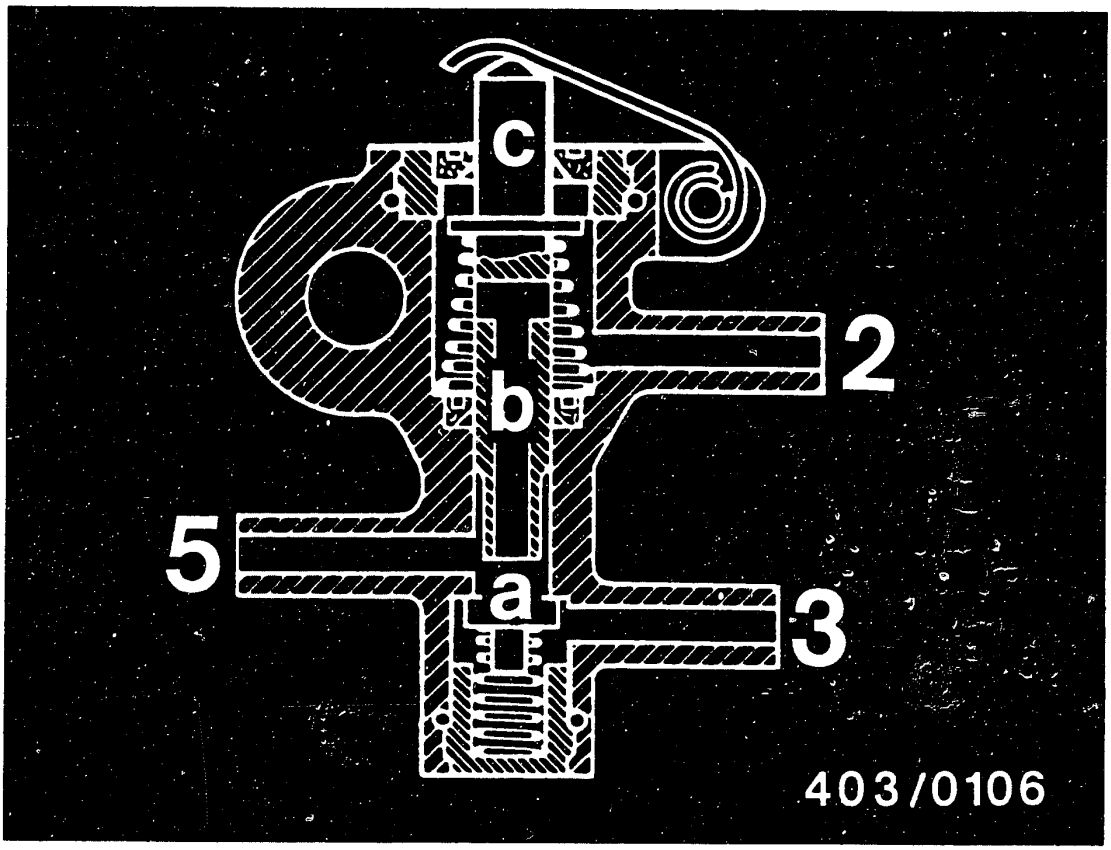
Change-over valve (idle cutoff)

The change-over valve is switched via the reverse-transfer lever with cam.
The change-over valve has the task of admitting air to the vacuum line to the EGR valve, thus switching off the exhaust-gas recirculation at idle (accelerator control linkage up against idle stop).
If the accelerator control linkage is actuated so far that the free travel (L) at the free-travel rod is bridged, the change-over valve has switched, and there is maximum possible exhaust-gas recirculation.

Change-over valve (full-load cutoff)

The change-over valve is switched by the second cam on the reverse-transfer lever shortly before the full-load position is reached. This admits air to the vacuum line to the EGR valve. There is no exhaust-gas recirculation.

Note:
The strap and the cam path must be clean and must not be lubricated.
In the case of engine preservation, they must be covered.



Note:
In the idle position (without free-travel bridging "L"), both change-over valves may have a through-passage from 2 to 5 only.
In the case of change-over valves that have switched through, there must be a passage between 3 and 5.

Restriction

Restrictions of different inside diameter may be installed between the two distributor pieces on the vacuum-control valve.

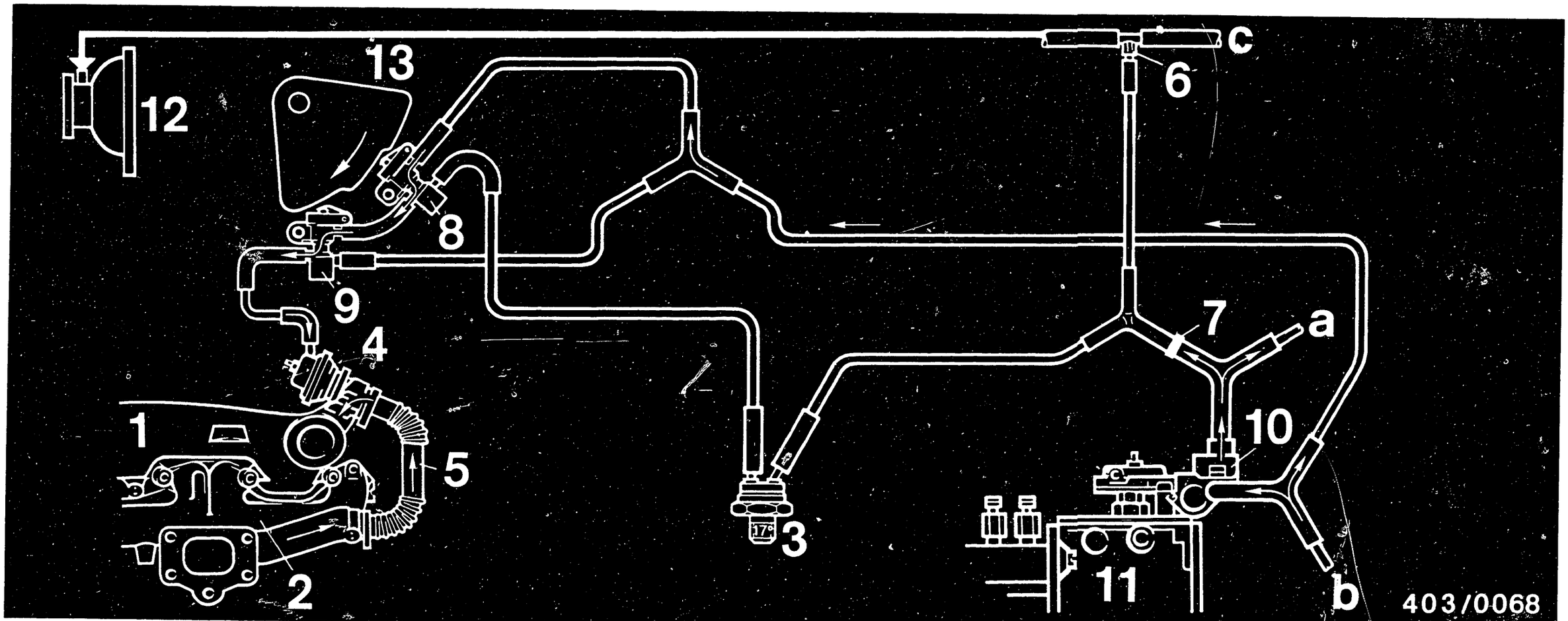
Color coding and diameter of restrictions:

green	=	0.7 mm diameter
white	=	0.8 mm diameter
blue	=	1.0 mm diameter
red	=	1.1 mm diameter
yellow	=	2.0 mm diameter (unrestricted)

The inside diameter of the restriction depends on the tolerances of the control angle at the injection-pump control lever and of the vacuum-control valve.

Vacuum-control valve

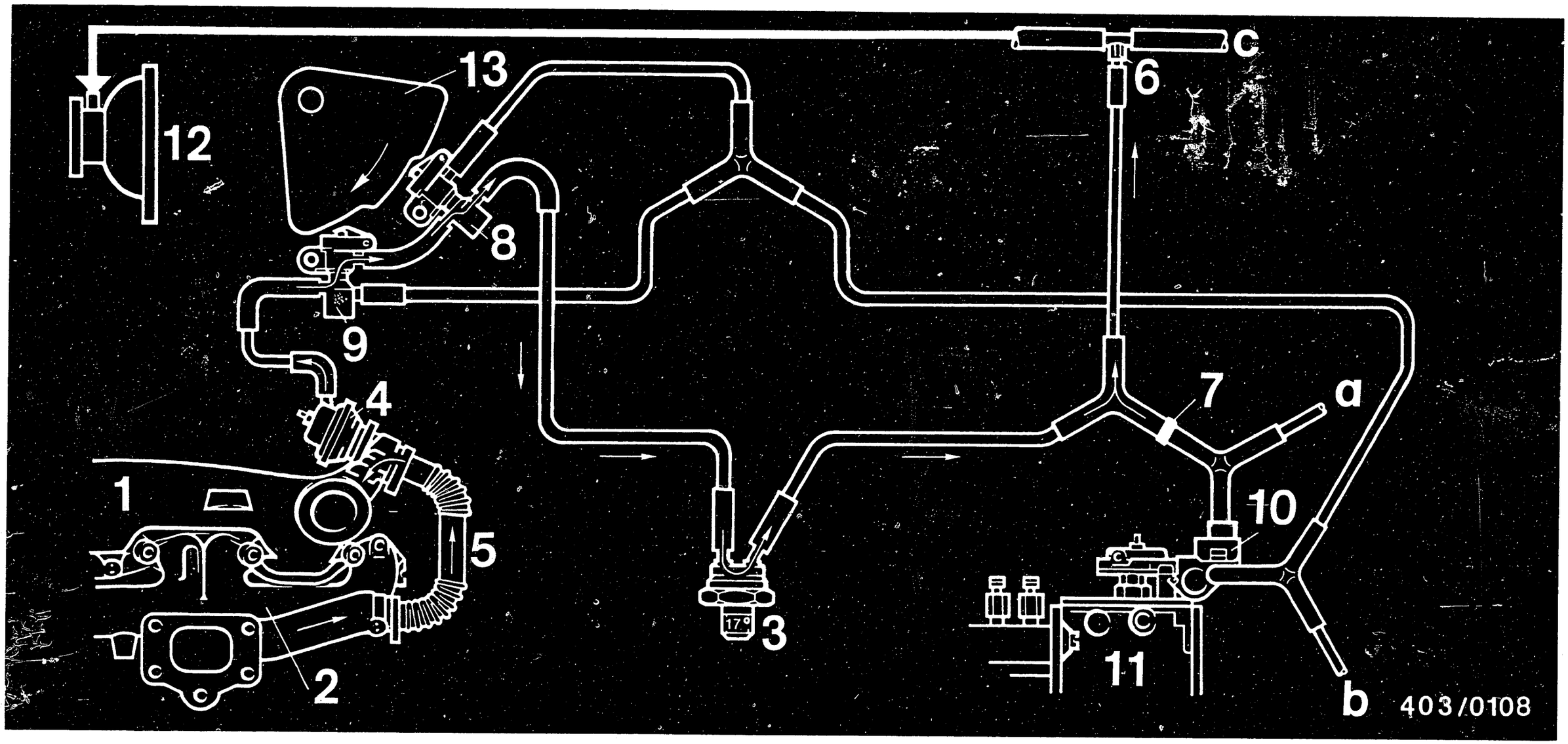
The vacuum-control valve controls the admission of air to the exhaust-gas recirculation valve (EGR valve). At idle, the vacuum line is constantly aired to the automatic transmission to the +17°C thermo-valve and change-over valve (idle cutoff) via a small annular groove in the vacuum-control valve.
The vacuum is approx. 350...500 mbar.
After the free travel has been bridged, with increasing load, the air-admission cross section in the vacuum-control valve is enlarged and the vacuum is thus reduced. The air is admitted through a plastic line which leads into the passenger compartment.



1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 17° thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction 0.6 mm
7 = Restriction
8 = Change-over valve - idle cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
a = Automatic transmission
b = Air line to passenger compartment
c = Brake assembly

31.3 Operating principle of exhaust-gas recirculation system

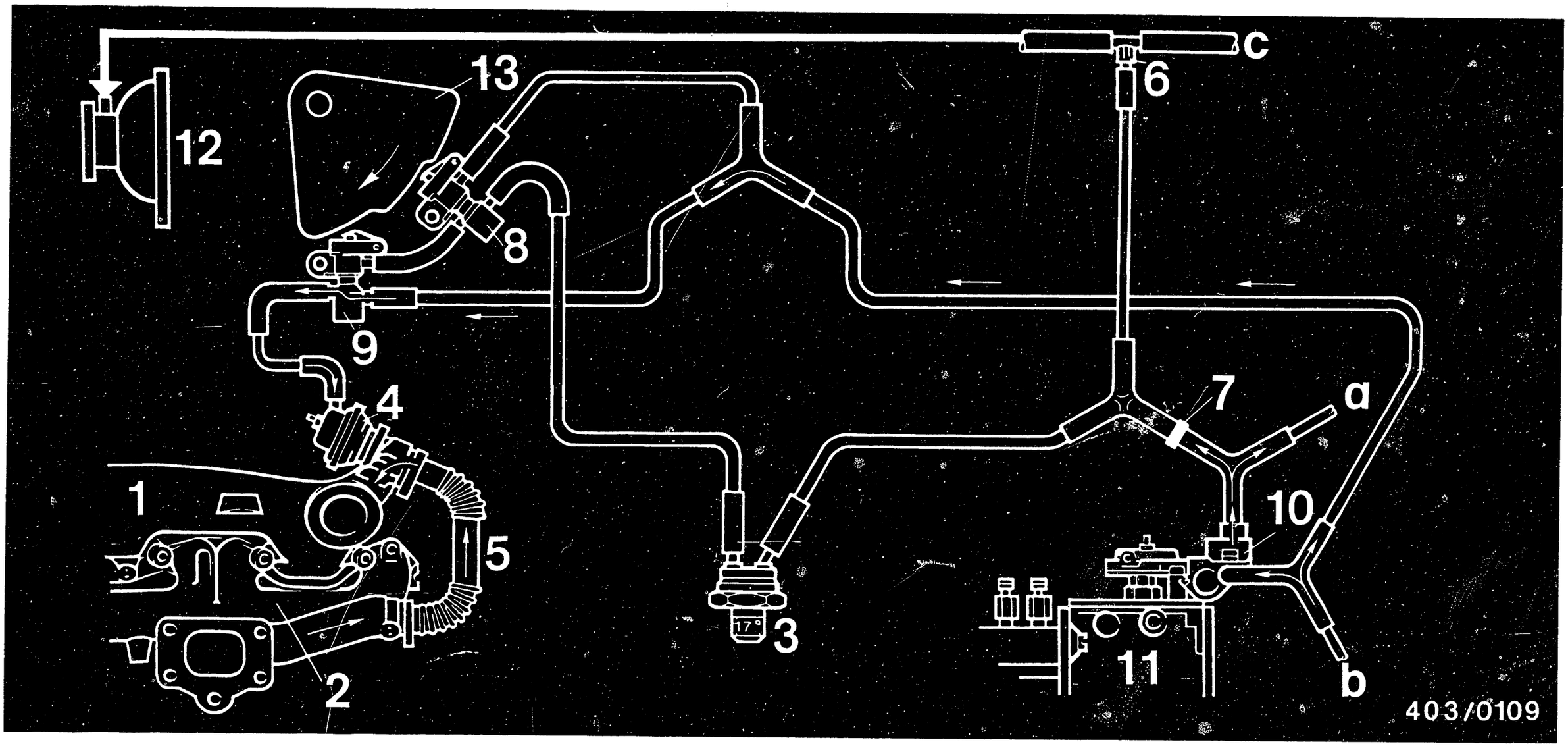
The EGR system is operative at coolant temperatures above +17°C: After bridging of the free travel at the free-travel rod and in the part-load range up to end cutoff of exhaust-gas recirculation just before full-load stop.
Below approx. +17°C coolant temperature, the thermo-valve (3) is closed. The vacuum cannot get to the EGR valve. There is no exhaust-gas recirculation.
As of a coolant temperature of approx. +17°C, the thermo-valve (3) opens. The vacuum (350...500 mbar at idle) gets to the change-over valve (8).
If the accelerator control linkage is at the idle stop, air is admitted to the exhaust-gas recirculation valve (4). There is no exhaust-gas recirculation.



1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 17° thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction
7 = Restriction
8 = Change-over valve - idle cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
a = Automatic transmission
b = Air line to passenger compartment
c = Brake assembly

Path of vacuum after bridging of free travel

When the accelerator control linkage is actuated so far that the free travel at the free-travel rod is bridged, the change-over valve (8) switches via the reverse-transfer lever (13) with cam. The vacuum now gets via the two change-over valves (8 and 9) to the EGR valve and opens it fully. This causes maximum exhaust-gas recirculation.



1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 17° thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction
7 = Restriction
8 = Change-over valve - idle cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
a = Automatic transmission
b = Air line to passenger compartment
c = Brake assembly

Path of air admission in full-load position

With increasing load, the vacuum is reduced via the vacuum-control valve (10). The quantity of recirculated exhaust gas becomes smaller. Just before the full-load position, the change-over valve (9) switches to air admission via the reverse-transfer lever (13) with cam. The vacuum is fully reduced; there is no exhaust-gas recirculation.

31.4 Test exhaust-gas recirculation system (1980 model year)

Test conditions: Accelerator control linkage must be correctly adjusted. Engine at operating temperature. Run engine at idle speed 750 ± 100 min^{-1}. Steering in straight-ahead position. Air conditioner off. Selector lever for automatic transmission in position "P". Connect vacuum tester to vacuum line between EGR valve and change-over valve.
At idle and with accelerator control linkage at idle stop, no vacuum may be measured. Move accelerator control linkage until the free travel at the free-travel rod has been bridged (do not pull by stop lever).
The vacuum must now be 350...500 mbar.

Is vacuum test specification of 350...500 mbar obtained?

no

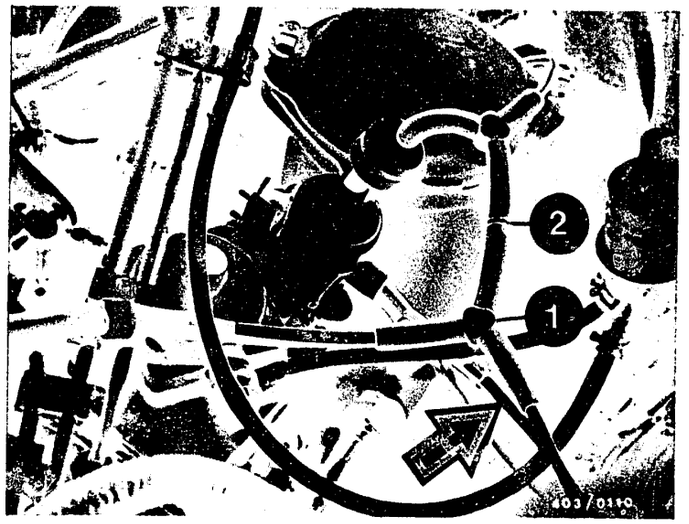
Vacuum line for controlling exhaust-gas recirculation of automatic transmission according to functional diagram. Check routing of vacuum line for correct connection and leaks.
Check the restriction (2) in the vacuum tap for throughflow. Check air line (arrow) from passenger compartment to vacuum-control valve for throughflow.

Check +17°C thermo-valve
Disconnect vacuum line from straight connection of thermo-valve. Disconnect vacuum line from distributor piece (1) and check for throughflow.

yes

Continued on K11/K12

Continued on K7/K8



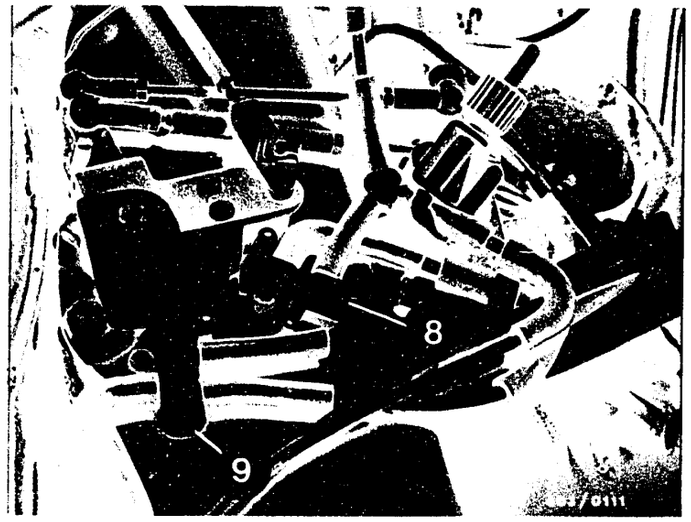
1 = Distributor piece
2 = Restriction

Test exhaust-gas recirculation system (1980 model year) (continued)

If there is no throughflow, replace thermo-valve. As the thermo-valve cools down, the thermo-valve should not have throughflow at temperatures below +17°C.

Test change-over valve (8)
Disconnect connection piece ( ) of vacuum line on change-over valve. Connect vacuum tester to free connection of change-over valve and connect to disconnected vacuum line. Vacuum reading approx. 350...500 mbar (accelerator control linkage at idle stop).
Leak test
Pinch off distributor piece of vacuum line. Vacuum must remain constant for approx. 2 minutes. If vacuum drops, replace the change-over valve.

yes



8 = Change-over valve (idle cutoff)
9 = Change-over valve (full-load cutoff)

Continued on K11/K12

Continued on K9/K10

Test exhaust-gas recirculation system (1980 model year) (continued)

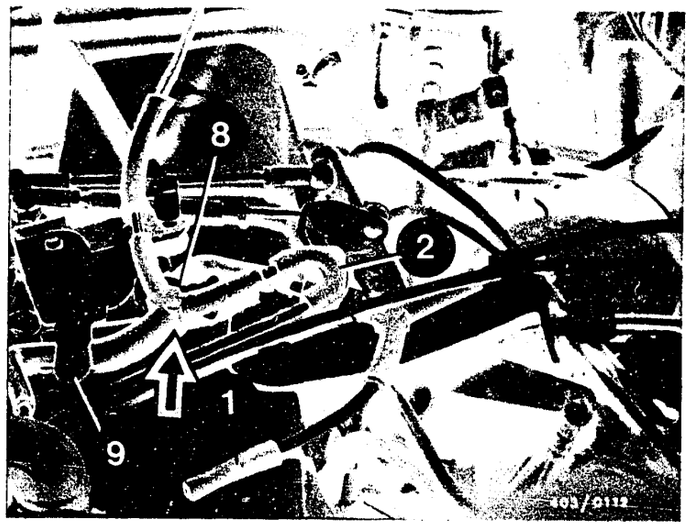
If vacuum remains constant, check change-over:

To do this, remove clamp, disconnect connecting hose between the two change-over valves and bridge free travel at free-travel rod.

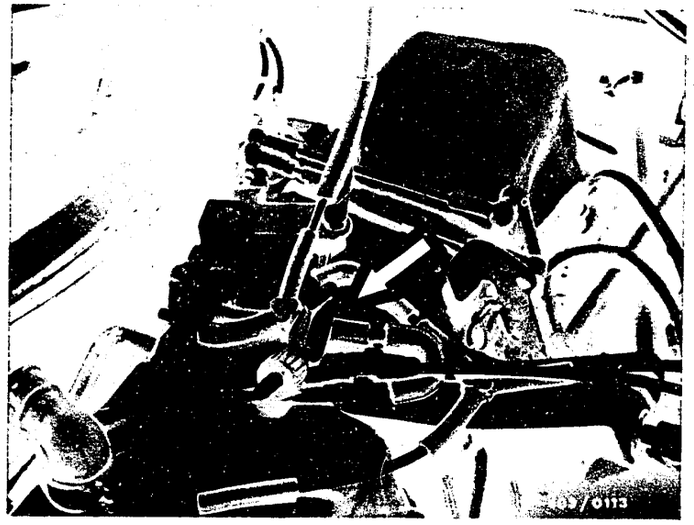
The vacuum must drop noticeably.
If the vacuum does not drop, replace change-over valve.

Check change-over valve (full-load cutoff):
Disconnect vacuum line (1) from change-over valve (9).
Disconnect vacuum line (2) from change-over valve (idle cutoff - 8).
Connect vacuum tester with Y-piece to free connection of change-over valve (arrow) and connect to the disconnected vacuum line (2).
Vacuum reading 350...500 mbar.

Leak test:
Disconnect distributor piece of vacuum line (bottom picture - arrow).
The vacuum must remain constant for approx. 2 minutes.
If the vacuum drops, replace the change-over valve.



yes



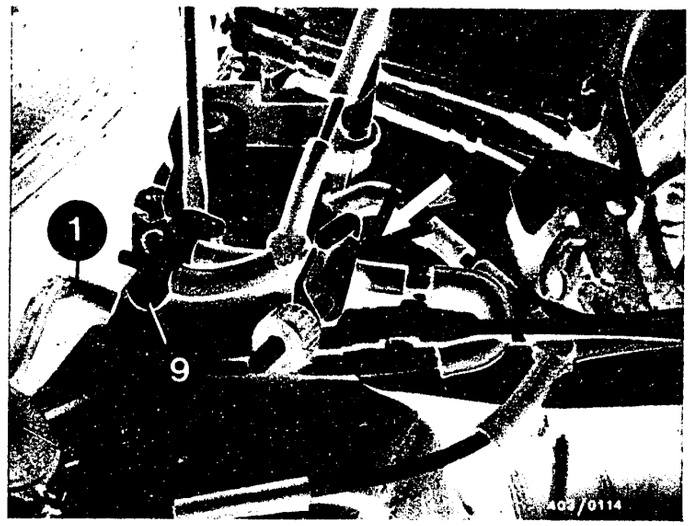
Continued on K11/K12

Continued on K11/12

Test exhaust-gas recirculation system (1980 model year) (continued)

If the vacuum remains constant, check change-over valve:
Remove clamp (top picture - arrow) and disconnect vacuum line (1) on change-over valve (9).
Switch change-over valve with screwdriver.
Vacuum must drop to 0 mbar.

If vacuum does not drop, replace change-over valve.

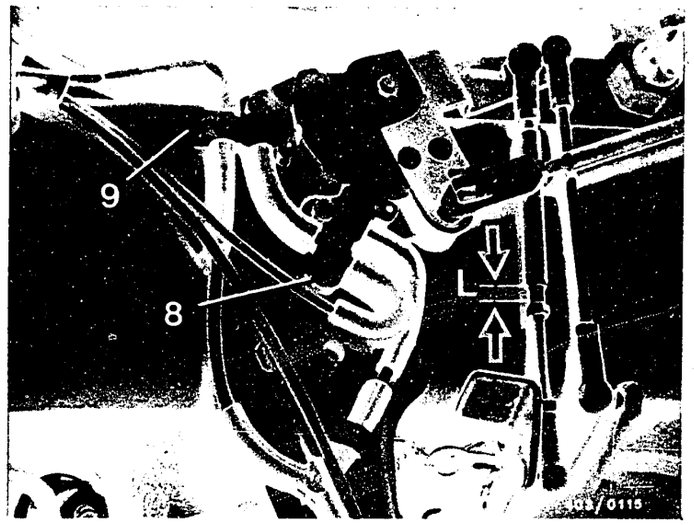


Test EGR valve.
Switch the change-over valve (idle cutoff - 8) by bridging the free travel "L" at the free-travel rod. Disconnect vacuum line from EGR valve and plug on again. The EGR valve must close audibly.

no → Replace EGR valve.

yes

Continued on K13/K14



Test exhaust-gas recirculation system (1980 model year)(continued)

Check vacuum control
Connect vacuum tester to the vacuum line between EGR valve and change-over valve. Raise idle to 1000 ± 10 min^{-1} by actuating the accelerator control linkage (do not pull on stop lever).

Test specification: 320...350 mbar

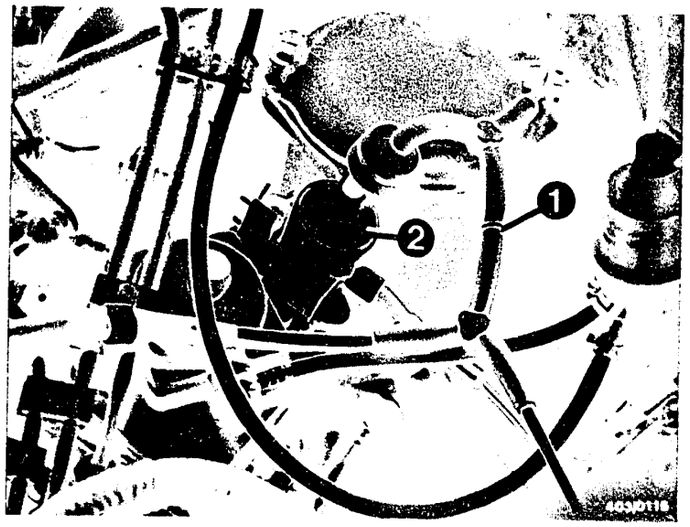
no →

Check restriction (1). Check restriction for throughflow. Change restriction.
If the vacuum is not obtained or exceeded, then, in case of too high a vacuum, the next larger, and in the case of too low a vacuum, the next smaller restriction must be installed.

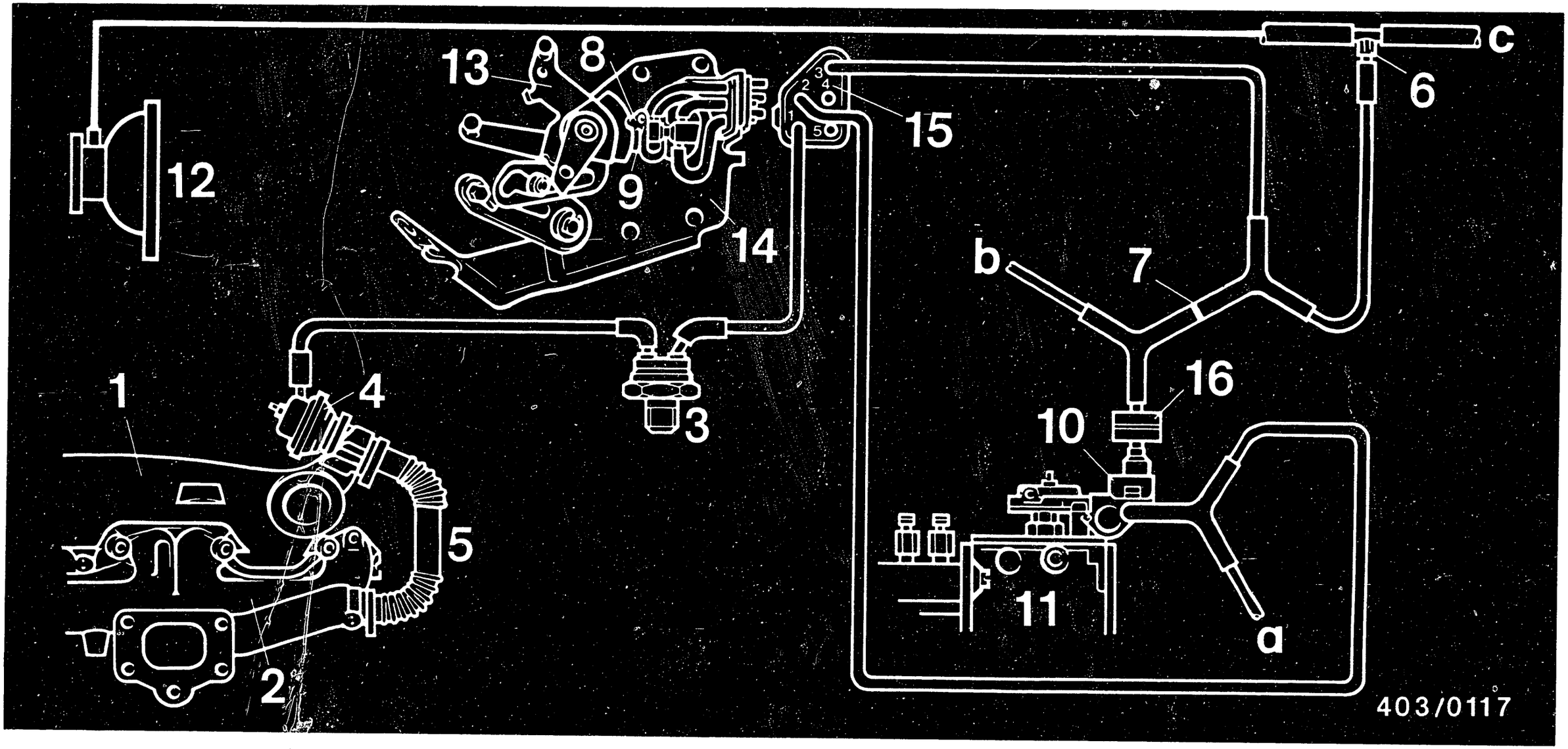
If, by installing a different restriction, the correct vacuum is not obtained, the vacuum-control valve (2) must be replaced.

yes ↓

Testing of exhaust-gas recirculation for 1980 model year completed.



1 = Restriction
2 = Vacuum-control valve



1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 40°C thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction
7 = Restriction
8 = Change-over valve - idle-cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
14 = Valve plate
15 = Central plug
16 = Vacuum damper
a = Air line to passenger compartment
b = Automatic transmission
c = Brake assembly

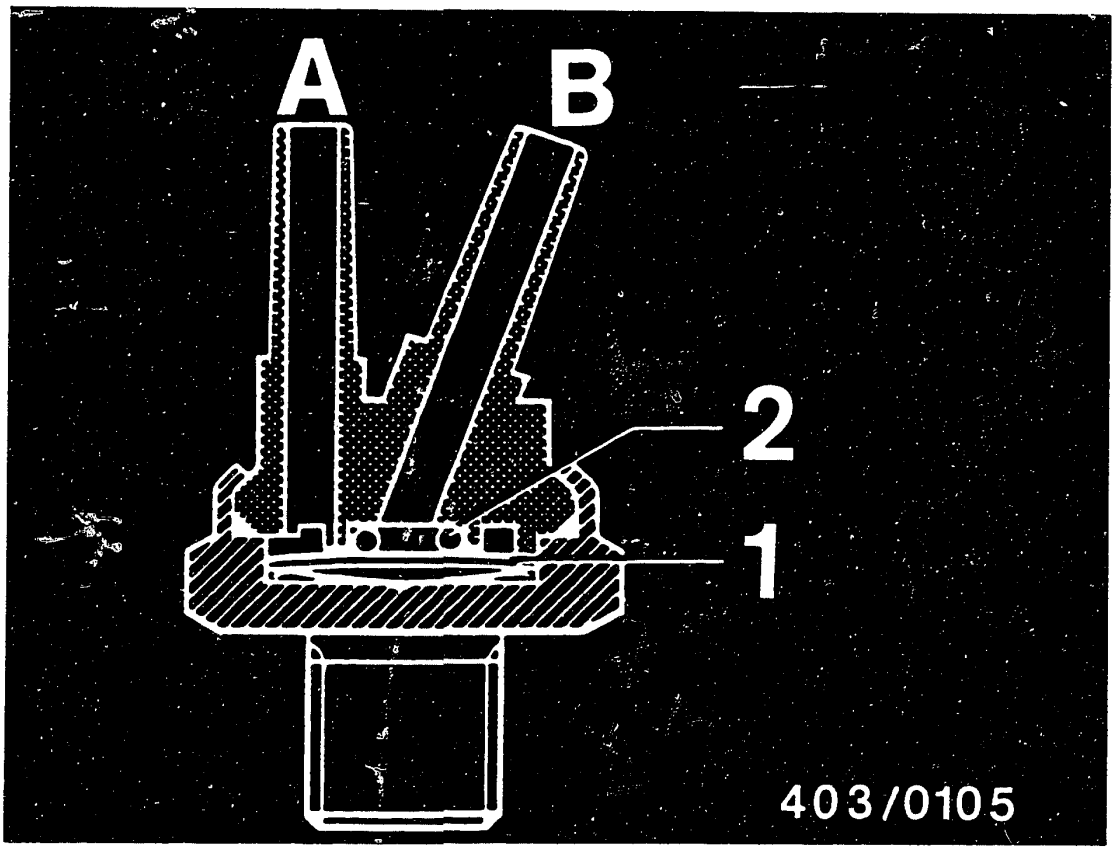
32. TEST EXHAUST-GAS RECIRCULATION SYSTEM (81, 82 AND 83 MODEL YEARS)

32.1 Diagram of air lines

32.2 Components of exhaust-gas recirculation and their operating principle

Vacuum tap with restriction

The vacuum tap for controlling the exhaust-gas recirculation system is taken from the vacuum line between vacuum pump and brake assembly.
A restriction (6) of 0.6 mm inside diameter is installed in the tap (not replaceable).



1 = Bimetallic plate
2 = O-ring
A = To change-over valve
B = To distributor piece (vacuum)

Thermo-valve +40°C

The thermo-valve is screwed into the thermostat housing.
Below approx. +40°C coolant temperature the bimetallic plate is in contact with the O-ring and closes connection "B". As of approx. +40°C coolant temperature the bimetallic plate moves downward due to heating. Both connection ports are then connected.

The vacuum line to the distributor piece must be connected at connection "B", because only in this way is there the guarantee of complete freedom from leaks between bitmetallic plate and O-ring.

Change-over valves

The change-over valves known from the 1980 model year are used for controlling the exhaust-gas recirculation system. However, the way in which they are arranged has been changed. Both change-over valves are mounted one on top of the other on the valve plate. The connection is by means of a central plug (15). In order to prevent dirt at the plastic bearing track, a cover plate is fitted.

Restriction

Restrictions of different inside diameter may be installed between the two distributor pieces on the vacuum-control valve.

Color coding and diameter of restrictions:

green	=	0.7 mm diameter
white	=	0.8 mm diameter
blue	=	1.0 mm diameter
red	=	1.1 mm diameter
yellow	=	2.0 mm diameter (unrestricted)

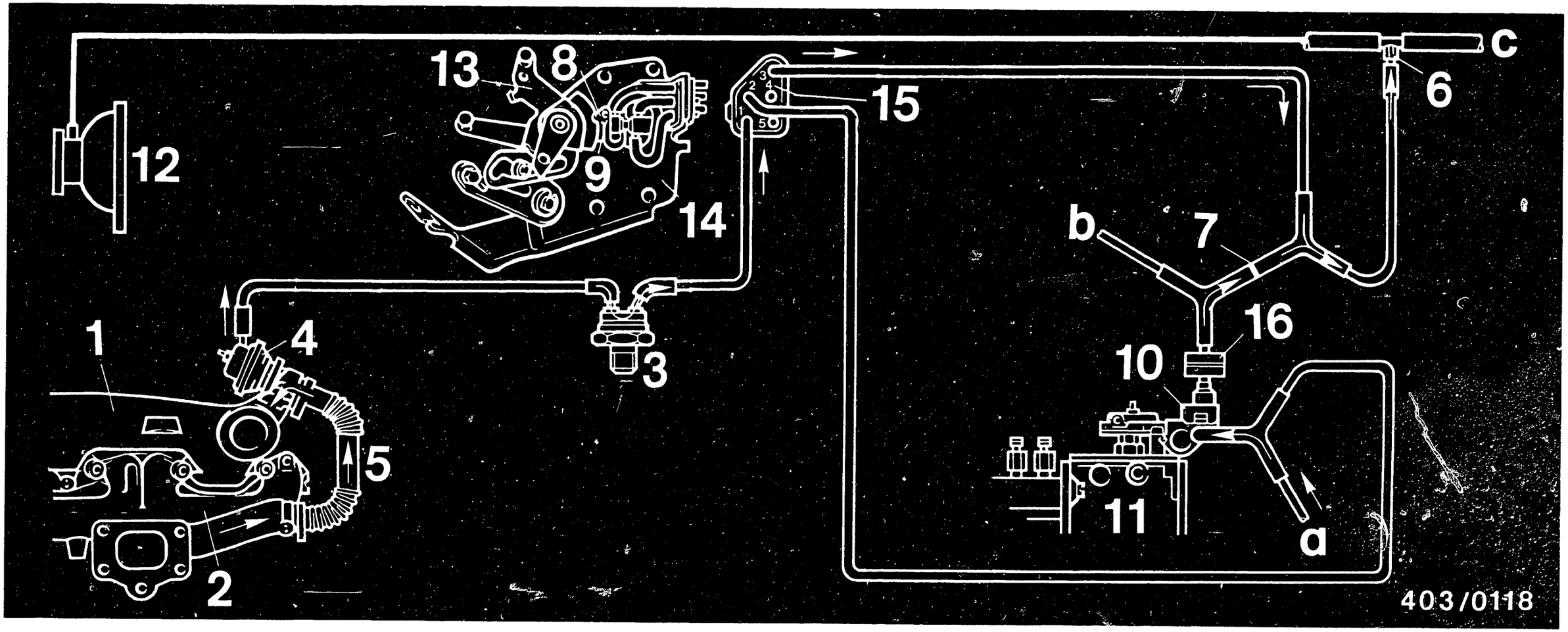
The inside diameter of the restriction depends on the tolerances of the control angle at the injection-pump control lever and of the vacuum-control valve.

Vacuum-control valve

The vacuum-control valve controls the admission of air to the exhaust-gas recirculation valve (EGR valve). At idle, the vacuum line is constantly aired to the automatic transmission to the +17°C thermo-valve and change-over valve (idle cutoff) via a small annular groove in the vacuum-control valve.
The vacuum is approx. 350...500 mbar.
After the free travel has been bridged, with increasing load, the air-admission cross section in the vacuum-control valve is enlarged and the vacuum is thus reduced. The air is admitted through a plastic line which leads into the passenger compartment.

Vacuum damper

To reduce the high vacuum peaks, a damper is installed in the vacuum line between the vacuum-control valve and the central plug (valve plate).

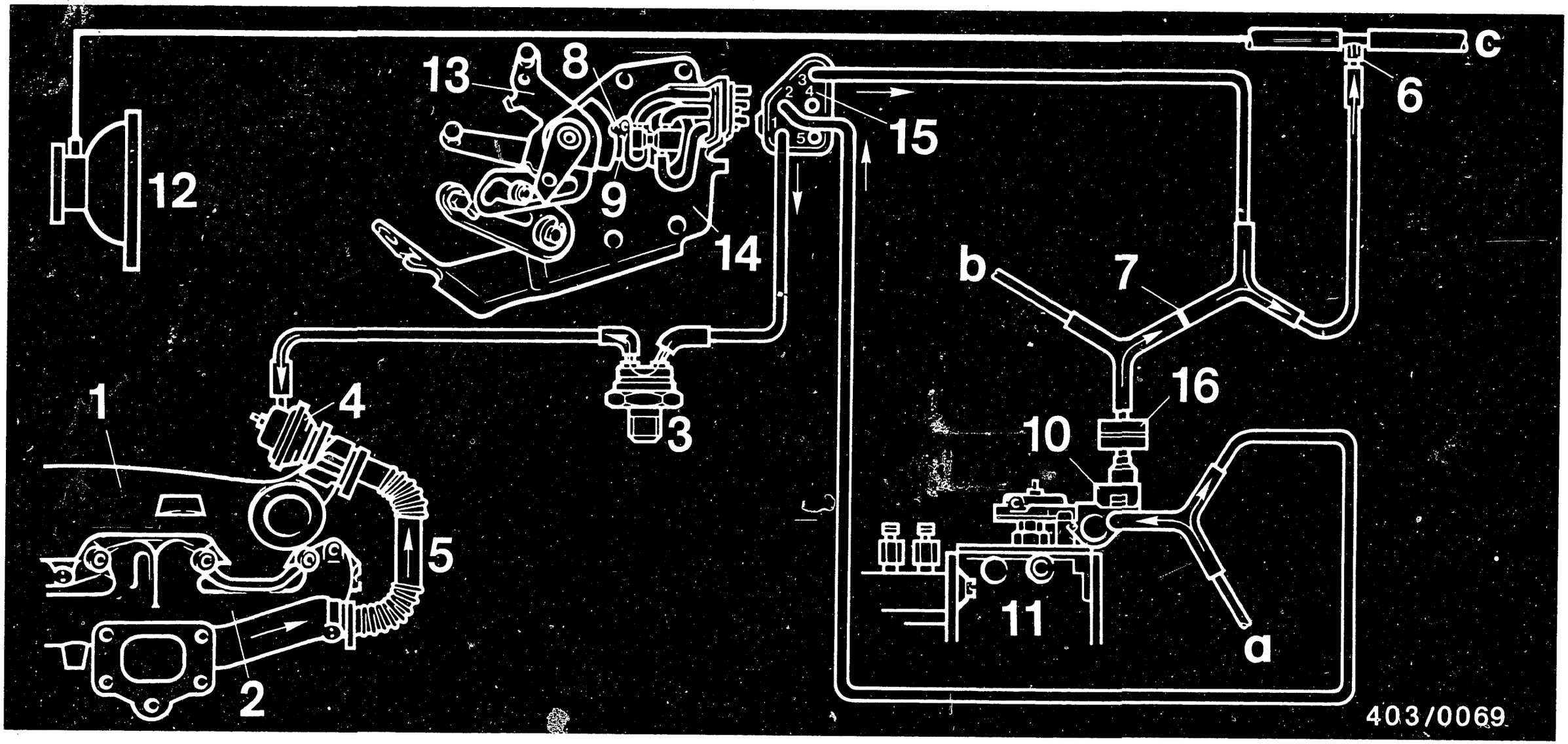


1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 40°C thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction
7 = Restriction
8 = Change-over valve - idle-cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
14 = Valve plate
15 = Central plug
16 = Vacuum damper
a = Air line to passenger compartment
b = Automatic transmission
c = Brake assembly

32.3 Operating principle of exhaust-gas recirculation

Path of vacuum after bridging of free travel

Exhaust-gas recirculation is operative at above +40°C coolant temperature after bridging of the free travel at the free-travel rod and throughout the entire part-load range. As of a coolant temperature of approx. +40°C the thermo-valve (3) opens.
The vacuum (350...500 mbar at idle) gets to the change-over valve (8). If the accelerator control linkage is at the idle stop, air is admitted to the EGR valve (4). There is no exhaust-gas recirculation. When the accelerator control linkage is actuated so far that the free travel at the free-travel rod is bridged, the change-over valve (8) switches via the reverse-transfer lever with cam (13). The vacuum now gets via the two change-over valves (8 and 9) to the EGR valve and opens it fully. This results in maximum exhaust-gas recirculation.



1 = Charge-air distribution pipe
2 = Exhaust manifold
3 = 40°C thermo-valve
4 = EGR valve
5 = Corrugated pipe
6 = Restriction
7 = Restriction
8 = Change-over valve - idle-cutoff - EGR
9 = Change-over valve - full-load cutoff - EGR
10 = Vacuum-control valve
11 = Fuel-injection pump
12 = Vacuum pump
13 = Reverse-transfer lever with cam
14 = Valve plate
15 = Central plug
16 = Vacuum damper
a = Air line to passenger compartment
b = Automatic transmission
c = Brake assembly

Path of air admission in full-load position

With increasing load, the vacuum is reduced via the vacuum-control valve (10). The quantity of recirculated exhaust gas becomes smaller. Just before the full-load position, the change-over valve (9) switches to air admission via the reverse-transfer lever (13) with cam. The vacuum is fully reduced; there is no exhaust-gas recirculation.

32.4 Test exhaust-gas recirculation system (81/82/83 model years)
Test conditions: Accelerator control linkage must be correctly adjusted. Engine at operating temperature. Run engine at idle at 750 ± 100 min^{-1}. Steering in straight-ahead position. Air conditioner off. Selector lever for automatic transmission in position "P". Connect vacuum tester between EGR valve (1) and on straight connection of thermo-valve (2). At idle, with accelerator control linkage at idle stop, no vacuum may be measured.
Move accelerator control linkage so far that the free travel at the free-travel rod is bridged (do not pull on stop lever).
The vacuum must now be 350...500 mbar.

Is vacuum test specification of 350...500 mbar obtained?

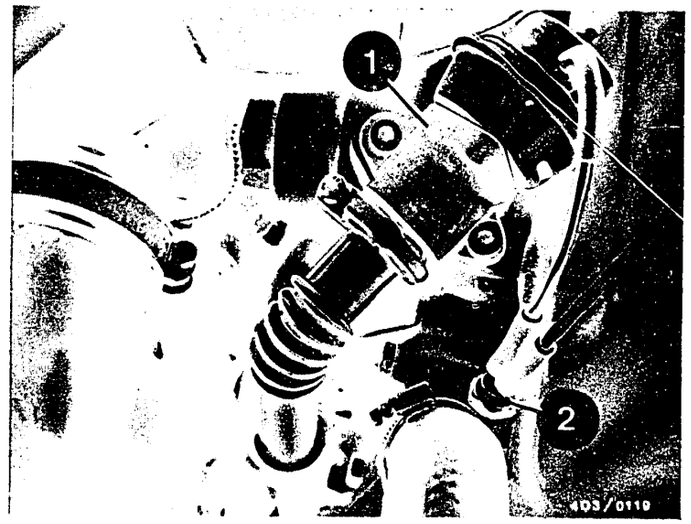
no → Check vacuum lines for EGR control and of automatic transmission in accordance with routing of vacuum lines functional diagram for correct connection and leaks. Check the restriction (6) in the vacuum tap for throughflow.

Test +40°C thermo-valve
Disconnect vacuum line from oblique connection port on thermo-valve. Disconnect vacuum line from exhaust-gas recirculation valve and check for throughflow. If there is no throughflow, replace thermo-valve.

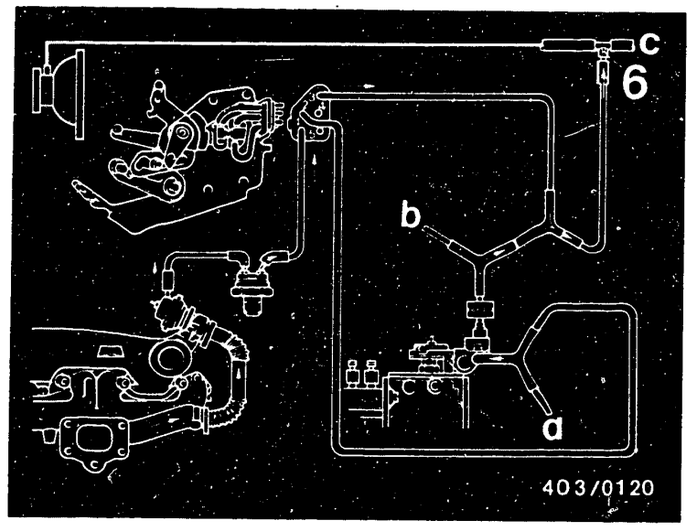
yes

Continued on L5/L6

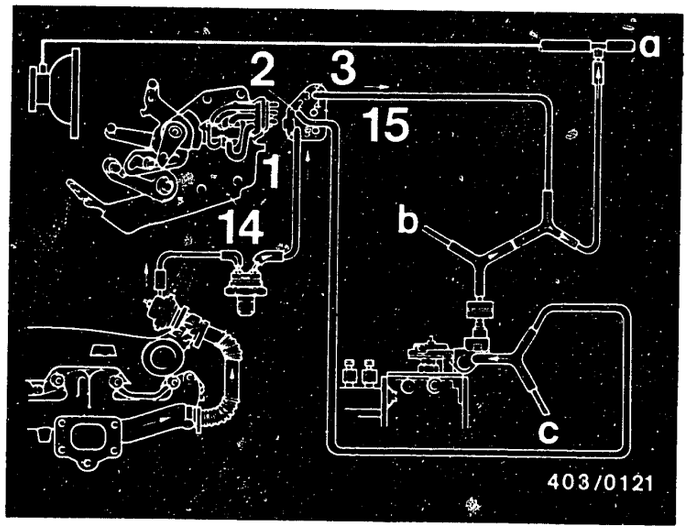
Continued on L5/L6



1 = EGR valve
2 = Thermo-valve
6 = Restriction



Test exhaust-gas recirculation system (81/82/83 model years) (coninuted)



Test change-over valve

Disconnect central plug (15) from valve plate (14).
Connect test line between tap on vacuum line, brake assembly and valve plate connection port (1).
Connect vacuum tester to connection port (3).
Seal connection port (2).

Vacuum reading at switchover:
Idle (accelerator control linkage at idle stop): 0 mbar.
Bridge idle (do not pull on stop lever): approx. 700...800 mbar.

Leak test
Return accelerator control linkage to idle stop.
Switch off engine.
Vacuum must remain constant for approx. 2 minutes.
Remove closure cap from connection port (2).
Bridge idle.
Vacuum must drop to 0 mbar. If value not obtained: replace change-over valve.

yes

Continued on L9/L10

Continued on L7/L8

Test exhaust-gas recirculation system (81/82/83 model years) (continued)

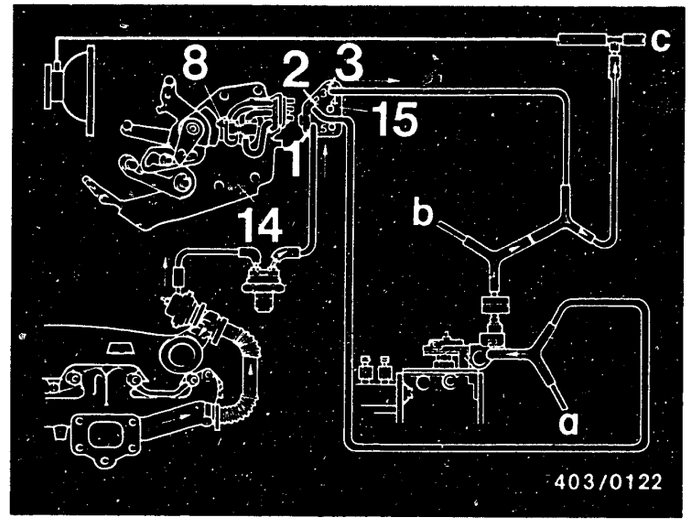
yes

Test change-over valve (8)

Disconnect central plug (15) from valve plate (14). Connect test line between tap on brake assembly vacuum line and valve plate connection port (1).
Connect vacuum tester to connection port (2).
Seal connection port (3) and start engine.
Vacuum reading at idle approx. 700...800 mbar (accelerator control linkage at idle stop).

Leak test:
Pinch off tap for test line.
Switch off engine. Vacuum must remain constant for approx. 2 minutes.

Vacuum reading at switchover:
Accelerator control linkage at full-load stop, vacuum must remain constant. Return accelerator control linkage to idle stop and disconnect test line. Vacuum must drop to 0 mbar. If test specifications not obtained, replace change-over valve (8).



8 = Change-over valve (idle cutoff)
14 = Valve plate
15 = Central plug

Continued on L9/L10

Test exhaust-gas recirculation system (81/82/83 model years) (continued)

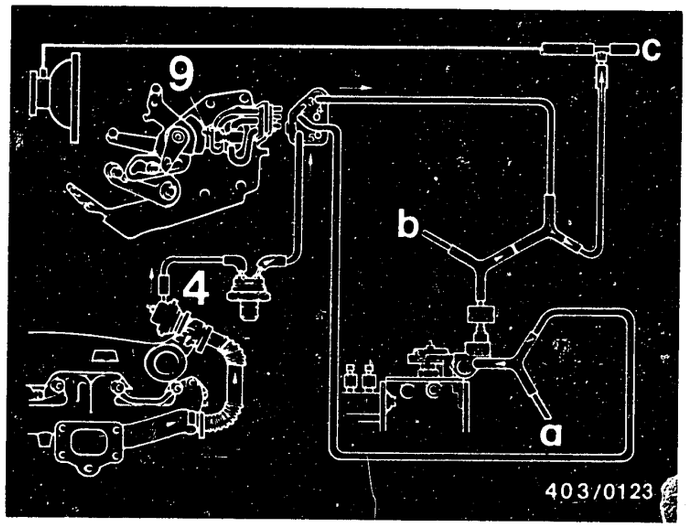
Test EGR valve (4)

Start engine.
Switch over change-over valve (9) by bridging the free travel "L" at the free-travel rod (bottom picture).
Disconnect vacuum line from EGR valve and plug on again. Does EGR valve close audibly?

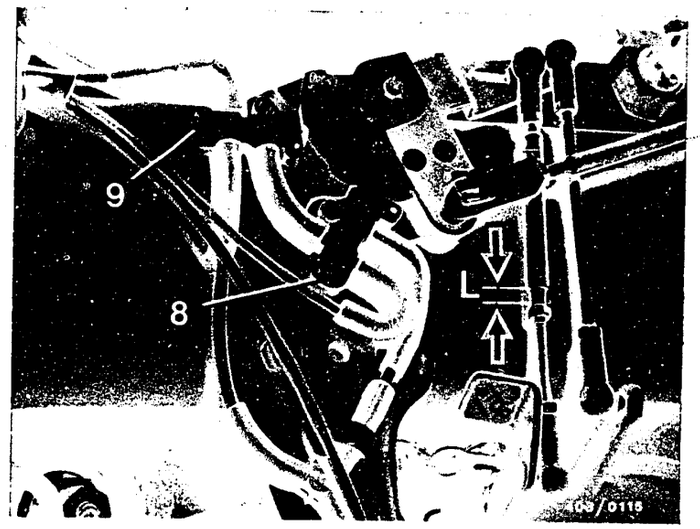
no → Replace EGR valve.

yes

Continued on L11/L12



4 = EGR valve
9 = Change-over valve (full-load cutoff)



Test exhaust-gas recirculation system (81/82/83 model years) (continued)

Test vacuum control
Connect vacuum tester to the vacuum line between EGR valve (1) and straight connection port of thermo-valve (2).
Raise idle to 1000 ± 10 min^{-1} by actuating the accelerator control linkage (do not pull on stop lever).

Test specification: 320...350 mbar

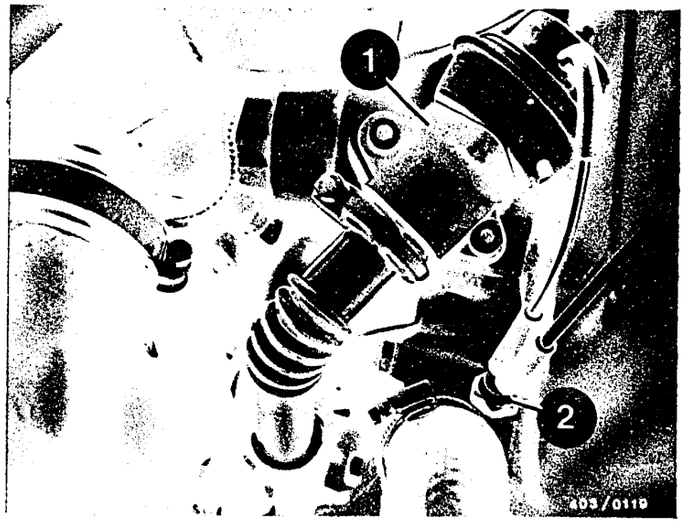
no →

Check restriction (4). Check restriction for throughflow.
Change restriction.
If the vacuum is not obtained or exceeded, then, in case of too high a vacuum, the next larger, and in the case of too low a vacuum, the next smaller restriction must be installed.

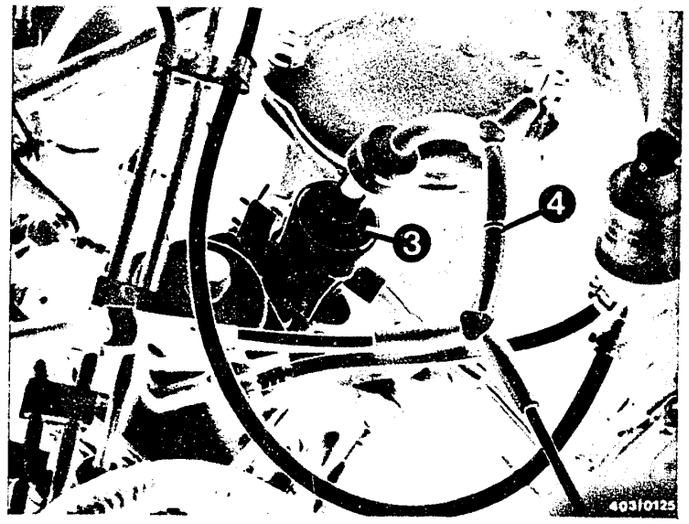
If, by installing a different restriction, the correct vacuum is not obtained, the vacuum-control valve (3) must be replaced.

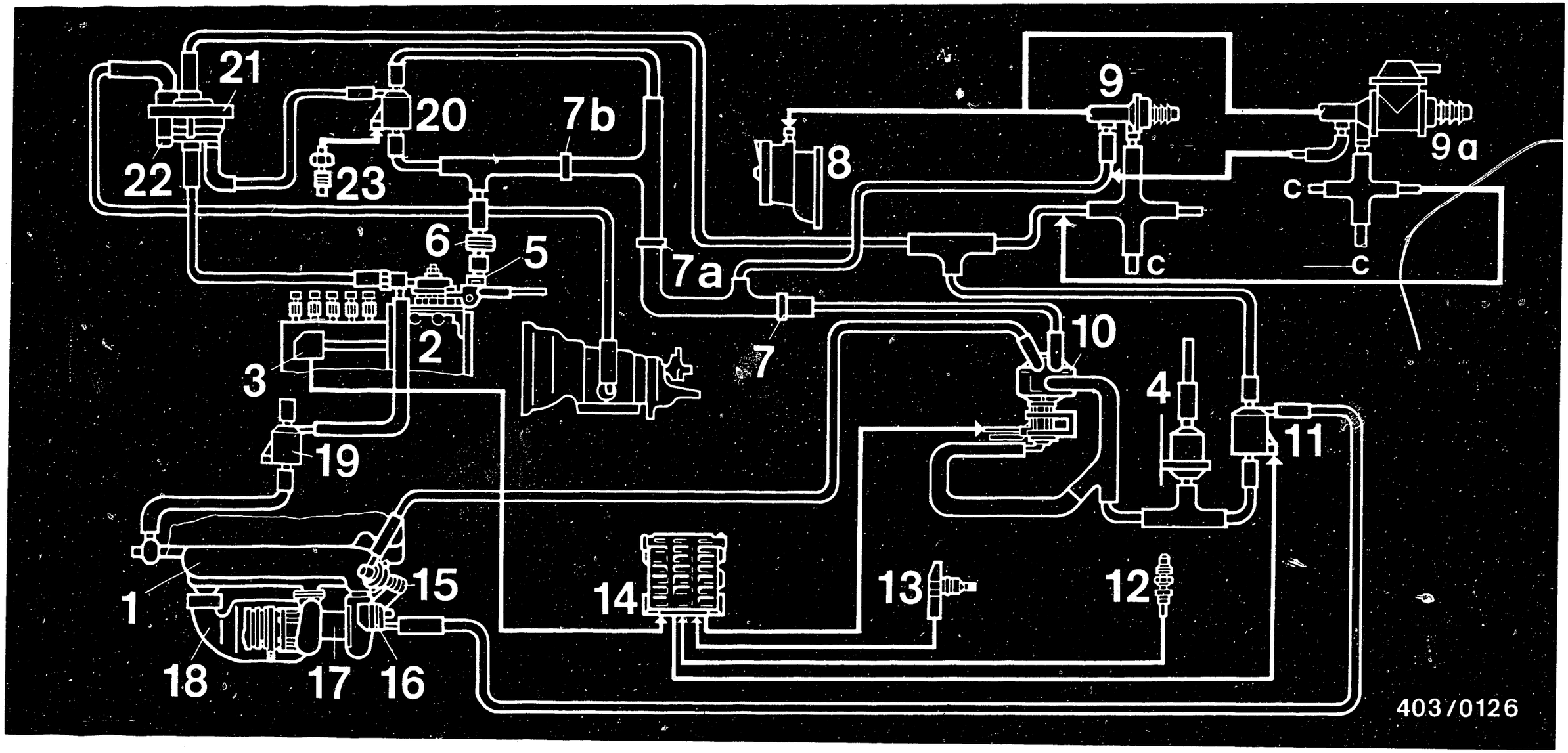
yes

Testing of exhaust-gas recirculation system for model years 81, 82 and 83 completed.



1 = EGR valve
2 = Thermo-valve
3 = Vacuum-control valve
4 = Restriction

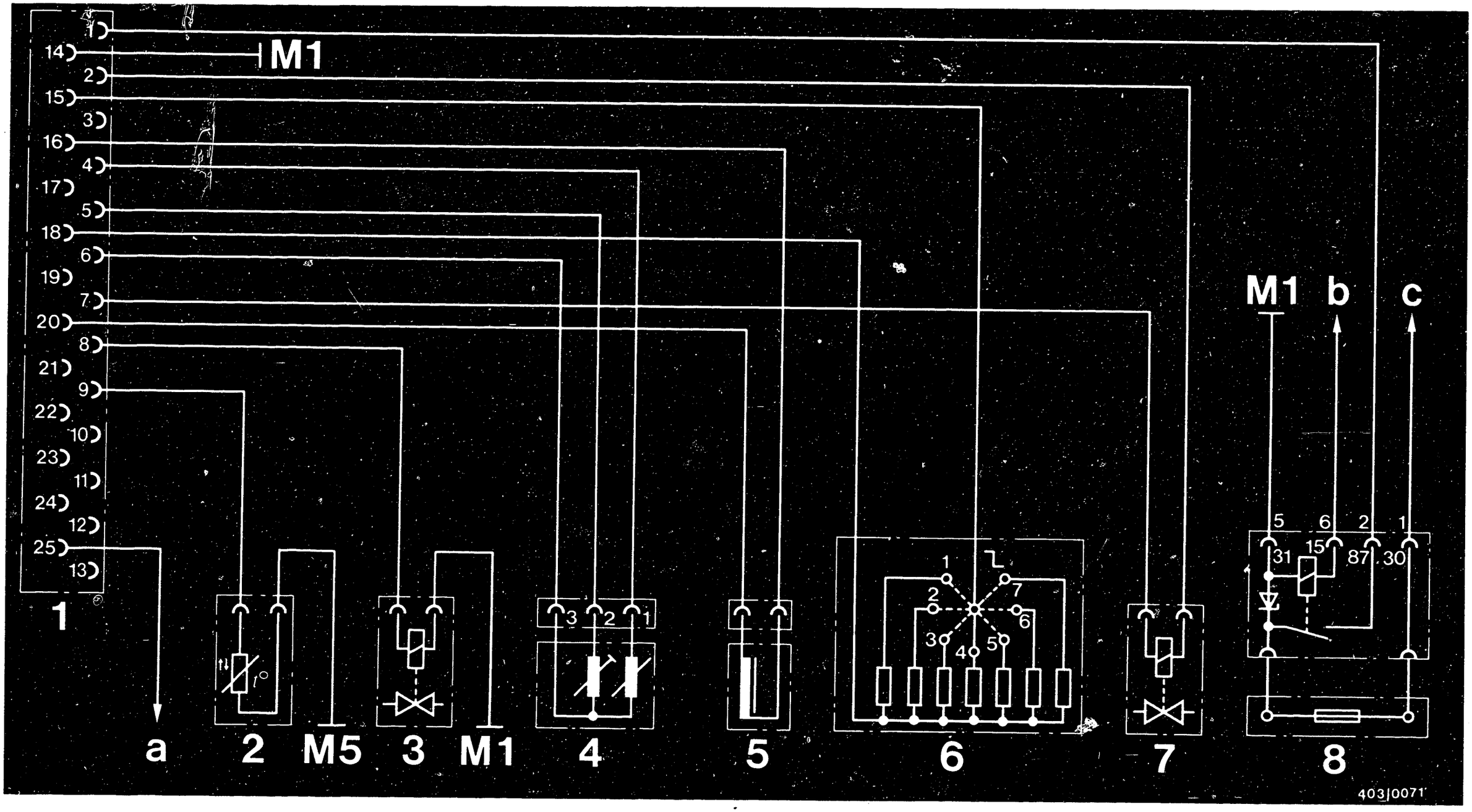




33. TEST EXHAUST-GAS RECIRCULATION SYSTEM (1984 MODEL YEAR) WITH CONTROL-ROD-TRAVEL SENSOR (RWG) AND SOOT BURN-OFF FILTER

33.1 Diagram of electric and pneumatic lines

1 = Intake manifold
2 = Injection pump
3 = Control-rod-travel sensor
4 = Air admission filter
5 = Vacuum-control valve
6 = Vacuum damper
7 = Restriction 0.5 mm
7a= Restriction 0.6 mm
7b= Restriction 0.6 mm
8 = Vacuum pump
9 = Non-return valve in type 123
9a = Non-return valve in type 126
10 = Pressure transducer
11 = Change-over valve
12 = Temperature sensor (coolant)
13 = Engine-speed sensor
14 = Control unit
15 = EGR valve
16 = Bypass-air safety valve
17 = Turbocharger
18 = Soot burn-off filter
19 = Change-over valve - overload protection
20 = Change-over valve - pressure converter
21 = Pressure converter
22 = Adjusting screw
23 = 50° thermo-switch



33.2 Electrical circuit diagram

1 = Control unit
2 = Control-rod-travel sensor
3 = Change-over valve
4 = Temperature sensor
5 = Pressure transducer
7 = Engine-speed sensor
8 = Overvoltage protection
M 1 = Main ground behind instrument cluster
M5 = Engine ground
a = To tachometer
b = To fuse box term. 15
c = To support point term. 30

33.3 Components of exhaust-gas recirculation system and their operating principle

Electronic control unit

The following signals are measured:
- Coolant temperature
- Engine speed
- Control-rod travel
- Atmospheric pressure

A barometric cell (altitude compensation) is installed inside the control unit. The input signals are processed and the pressure transducer and change-over valve are energized accordingly.

Pressure transducer

The vacuum generated by the vacuum pump of the engine is converted by the pressure transducer into a load-dependent vacuum signal and is used to control the exhaust-gas recirculation valve (EGR valve).

Coolant temperature sensor (NTC)

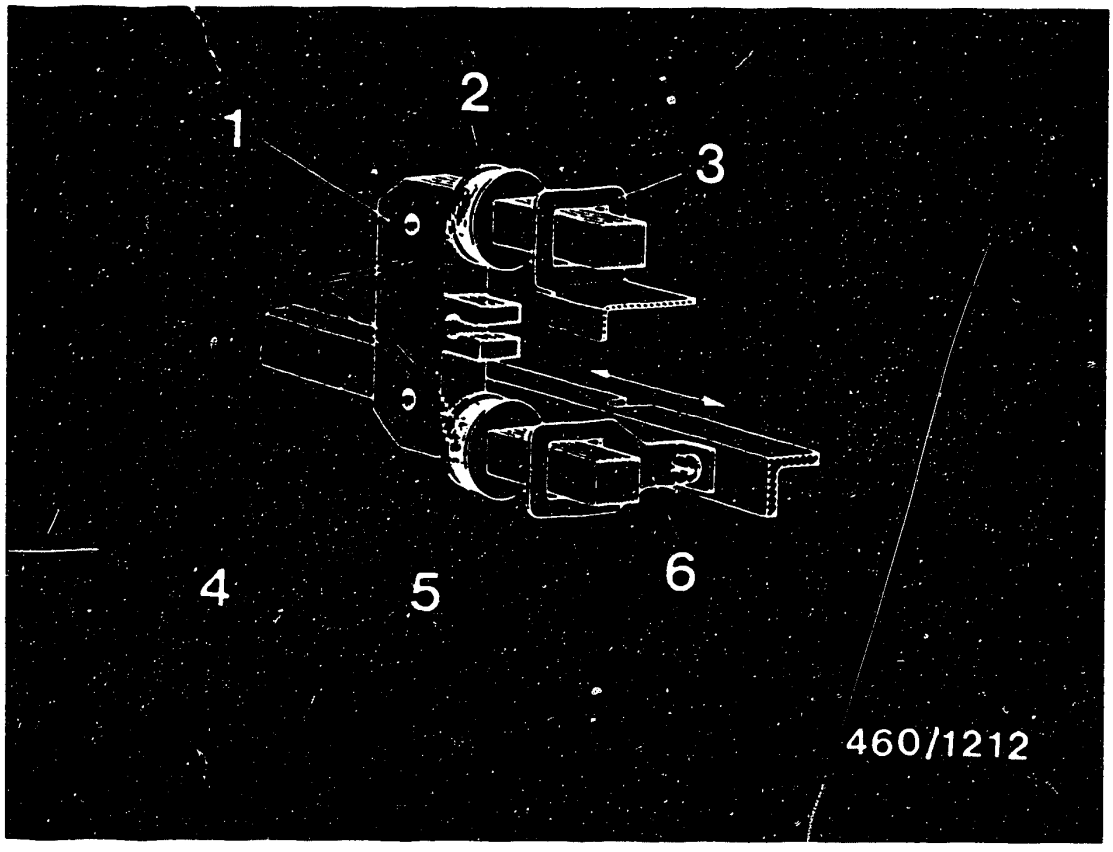
The coolant temperature is measured by a temperature sensor.
The resistance of the temperature sensor changes as a function of the coolant temperature.

Engine-speed sensor

The engine-speed sensor measures the engine speed and relays it in the form of an AC voltage to the control unit.

Control-rod-travel sensor

The control-rod-travel sensor consists of an iron core, two coils (measured value and fixed value) and two short-circuit rings. It is connected to the electronic control unit by a 3-pin plug.
The coils are attached on the iron core which is fixed in the housing. The short-circuit ring is connected to the control rod and moves contactlessly on the lower arm of the iron core.
Fixed-value coil and short-circuit ring are mounted on the upper arm.



1 = Iron core
2 = Fixed-value coil
3 = Short-circuit ring (fixed)
4 = Control rod
5 = Measuring coil
6 = Short-circuit ring (movable)

Operating principle:
The fixed-value coil (2) with the short-circuit ring (3) represents a constant inductance.

Depending the change of position of the control rod (4), the distance between short-circuit ring (6) and measuring coil (5) changes.
The thus generated, variable inductance is compared with the constant.
From this, the electronic control unit calculates the control-rod travel.

Change-over valve (electric)

The change-over valve is energized by the control unit according to the load condition of the engine and enables vacuum to be applied to the bypass-air safety valve.
The bypass-air safety valve opens and allows some of the charge air before the compressor to flow back via a bypass.

33.4 Operating principle of exhaust-gas recirculation (EGR)

Exhaust-gas is recirculated when the following points are met.

- Coolant temperature min. +40°C
- Engine speed min. 500 min^{-1}
- Control-rod travel (load) signal of injection pump

Idle: Auxiliary equipment off, selector lever in position "P" or "N"

Part load: Auxiliary equipment on and selector lever in drive position.

The resistance of the coolant temperature sensor changes as a function of the coolant temperature and thus provides the input signal for the EGR control electronics.

At an engine speed between 500 and approx. 1000 min^{-1} (engine-speed range without load) the pressure transducer is energized with approx. 530 mA. (The pressure transducer and the change-over valve are energized by the control unit from the processing of the input signals of control-rod travel, engine speed and engine temperature.) This results in a vacuum at the EGR valve of approx. 290 mbar. The valve opens fully, as a result of which there is maximum exhaust-gas recirculation.

By selecting a drive mode and switching on auxiliary equipment, a certain load signal is exceeded. The pressure transducer is deenergized and the vacuum to the EGR valve is removed. There is no longer any exhaust-gas recirculation.

At an engine speed above 1000 min^{-1} in the part-load range the pressure transducer is likewise energized with approx. 530 mA. This results in maximum exhaust-gas recirculation.

With increasing load, the current is reduced to 370 mA. As of a certain load signal, the pressure transducer is deenergized and the vacuum at the EGR valve is reduced, thereby reducing the recirculation of exhaust gas.

At 370 mA the vacuum at the EGR valve is 190 mbar. This is the closing point for the EGR valve; there is no longer any exhaust-gas recirculation.

In addition, at an engine speed above 1000 min^{-1} and with the corresponding load signal, the bypass-air safety valve is completely opened.

With increasing altitude the quantity of recirculated exhaust gas is reduced according to the air pressure by a barometric cell which is integrated in the control unit.

33.5 Test exhaust-gas recirculation system (1984 model year)

Test conditions: Accelerator control linkage must be correctly adjusted. Engine at operating temperature. Battery voltage min. 12 V. Steering in straight-ahead position. Air conditioner off. Selector lever for automatic transmission in position "P".

Test EGR valve (top picture - 1) with engine stopped

Apply approx. 300 mbar vacuum to EGR valve. Disconnect vacuum line.

Does EGR valve close audibly?

no → Replace EGR valve.

yes

Check voltage at pressure transducer (bottom picture - 2).

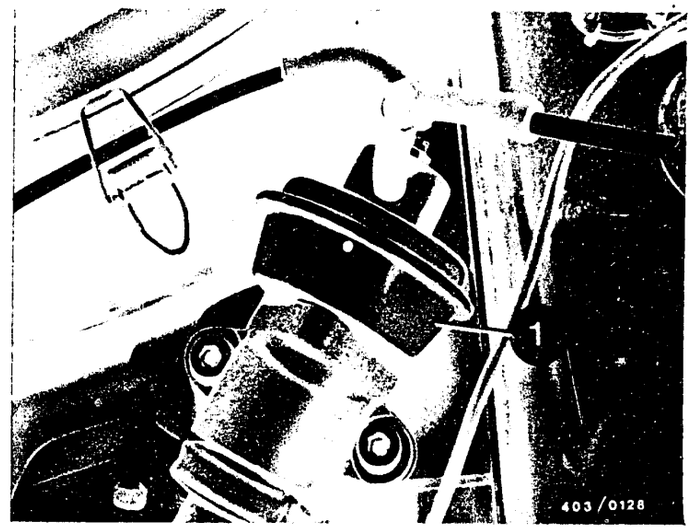
Engine off. Switch on ignition. Disconnect plug from pressure transducer and connect to multimeter (bottom picture - arrow). Specified voltage 12 V.

Test specification obtained?

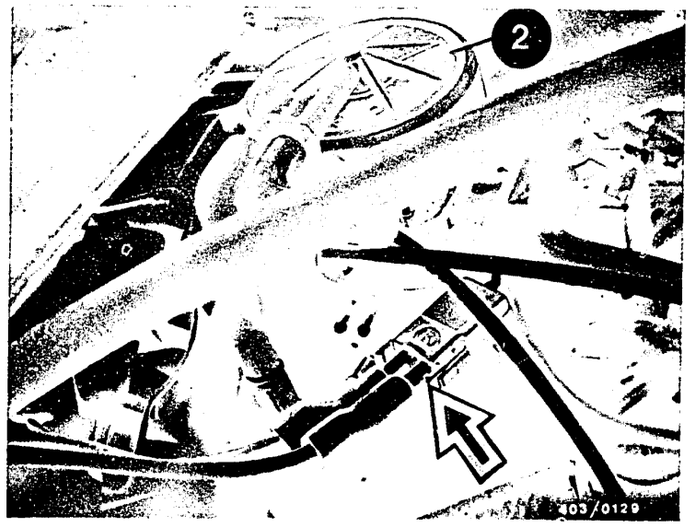
no → Check overvoltage protection and electrical energization according to circuit diagram.

yes

Continued on M3/M4



1 = EGR valve
2 = Pressure transducer



Test exhaust-gas recirculation system (1984 model year) (continued)

Test vacuum control

Connect vacuum tester to EGR valve with Y-distributor.

Read off vacuum values at the following engine speeds:

Engine speed	Vacuum
700...2600 min^{-1}	280...360 mbar
as of approx. 2400 min^{-1}	slowly falling
3000 min^{-1}	approx. 60 mbar

Vacuum values O.K.?

no → Test individual components.

yes

Testing of exhaust-gas recirculation system for the 1984 model year completed.

33.6 Test individual components

Test temperature sensor (coolant).

Switch off engine.
Disconnect plug from temperature sensor.
Test resistance to ground.
See graph for specified values.
Test resistance at temperature measuring points.

Example:

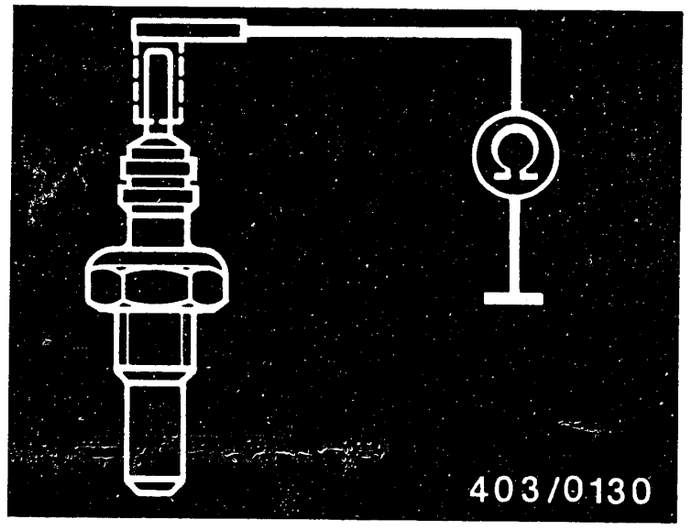
+20°C ≙ 2.2 ... 2.8 kΩ

+80°C ≙ 290 ... 364 Ω

Test specifications O.K.?

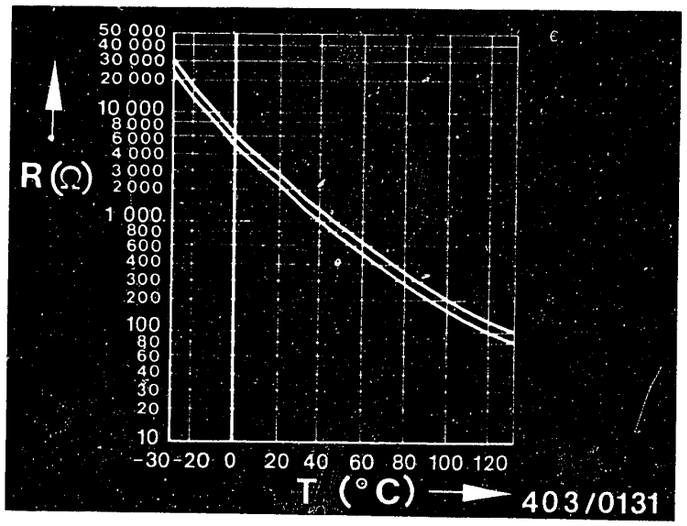
no → Replace temperature sensor.

Installation position: On left-hand side of cylinder head.



yes

Continued on M7/M8



Test engine-speed sensor

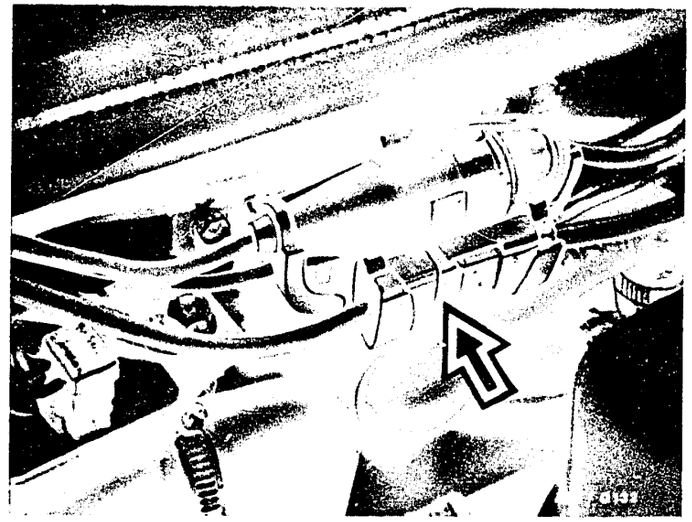
Engine off.
Disconnect connector (arrow) and test resistance with multimeter.

Test specification: 1.9 ± 0.2 kΩ

Test specifications O.K.?

no → Replace engine-speed sensor.

Installation position:
On intermediate flange to automatic transmission.



Arrow = Connector

yes

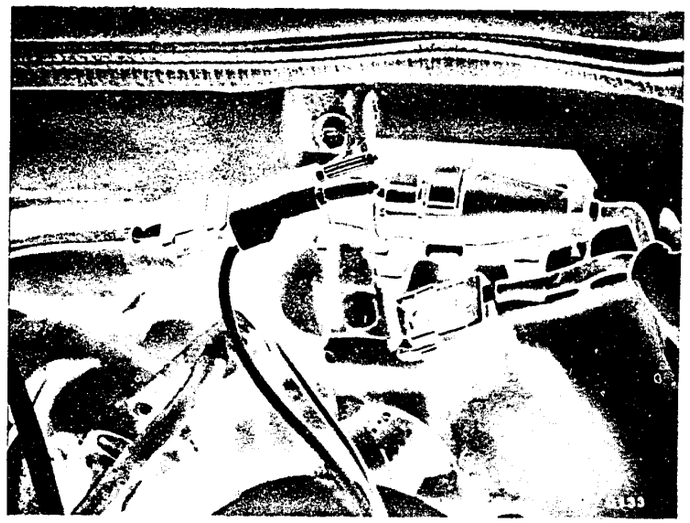
Measure AC voltage with multimeter.
Read off test (voltage value) at following engine speed:

Engine speed	Voltage
700...800 min^{-1}	min. 4.0 V (AC voltage)

Note:
Rising voltage with rising engine speed

Test specifications O.K.?

no → Replace engine-speed sensor.



yes

Continued on M9/M10

Test control-rod-travel sensor

Engine off.
Disconnect connector. Test resistance (measuring range approx. 100 Ω) with multimeter.

Resistance values

between pins 1 and 2: 23...27 Ω

between pins 2 and 3: 23...27 Ω

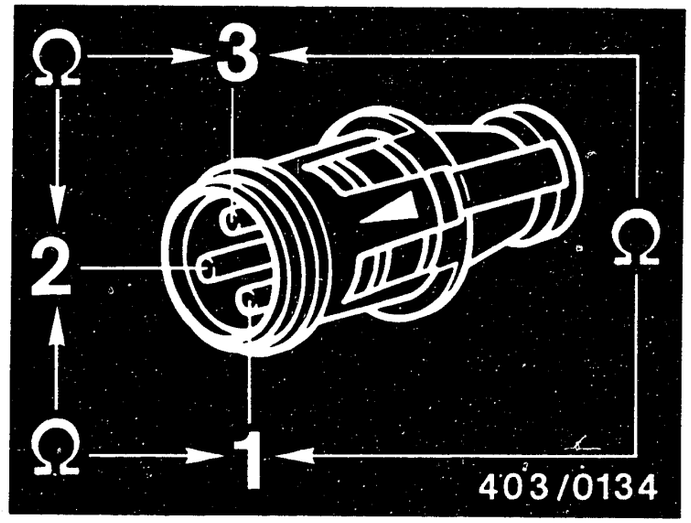
between pins 1 and 3: 44...56 Ω

Test specifications O.K.?

no →

Remove injection pump with control-rod-travel sensor.

Note:
The control-rod-travel sensor must not be removed from the pump on the vehicle or be changed in its position.
The control-rod-travel sensor is set on the injection-pump test bench with evaluation circuit.



yes

Continued on M11/M12

Test pressure transducer (3)

Connect vacuum tester to connection for vacuum line (2). Run engine at idle speed and read off vacuum value.

Test specification approx. 450 mbar.

Test specification obtained?

no → Test vacuum lines and vacuum pump.

yes

Connect vacuum tester to connection (1) with Y-distributor. Connect multimeter to pressure transducer with test cable and measure current readings.
Read off test specifications at the following engine speeds:

Engine speed (min⁻¹)	Vaccum (mbar)	Current (mA)
700...2600	280...360	≙ 530
as of approx. 2400	slowly falling	≙ 370
approx. 3000	approx. 60	0

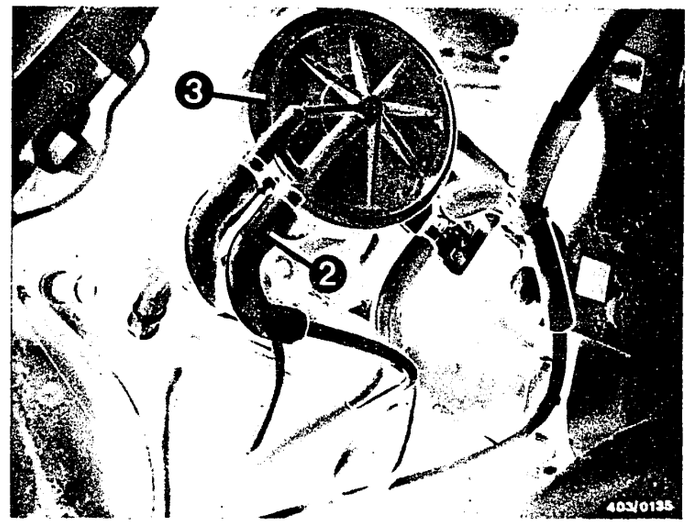
Test specifications O.K.?

no → If current readings O.K., replace pressure transducer.

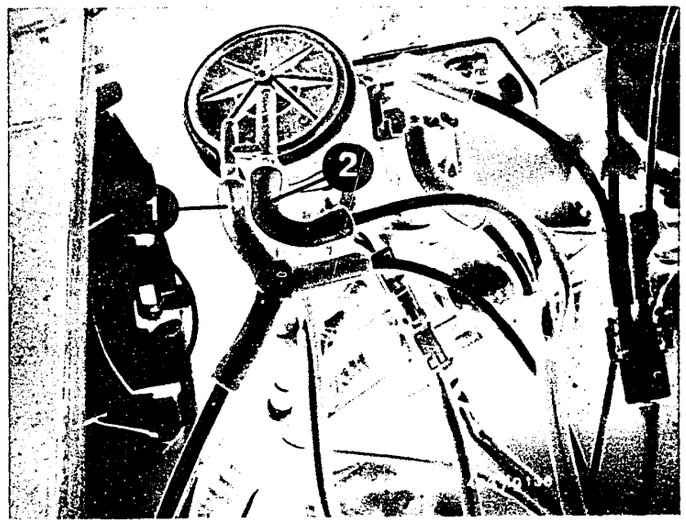
If current readings not O.K.:
Test energization according to electrical circuit diagram. If necessary, replace control unit.

yes

Continued on M13/M14



2 = Connection for vacuum line
3 = Pressure transducer



Test change-over valve

Connect vacuum tester to connection (a) with Y-distributor. Run engine at idle speed.
Read off vacuum.
Test specification min.approx. 600 mbar.

Vacuum reading O.K.?

no → Test vacuum lines according to diagram of lines.

yes ↓

Connect vacuum tester to connection (b) with Y-distributor. Connect test cable of multimeter to change-over valve.
Read off voltage at the following engine speeds:

Engine speed (min-1)	Vacuum (mbar)	Voltage (Volt)
700...800	0	0
1000...2500	approx. 60	approx. 12
min. 3000	0	0

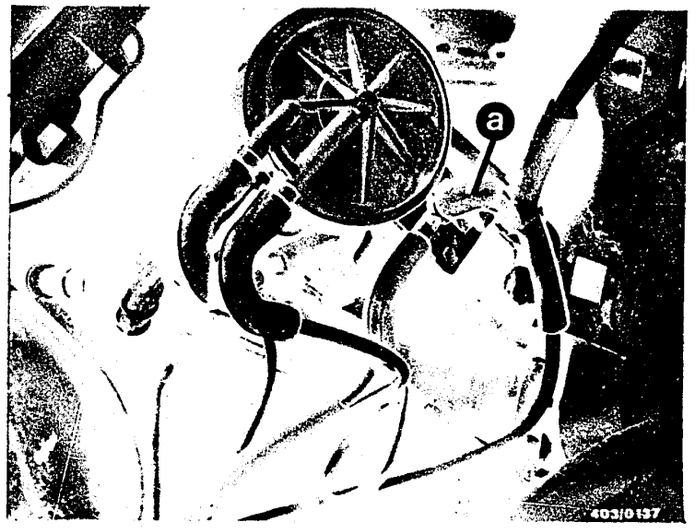
Test specifications obtained?

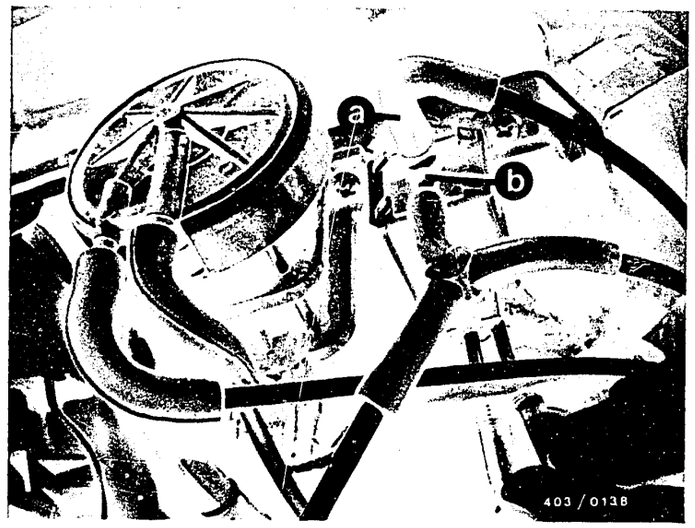
no → If voltage readings O.K., replace change-over valve.

If voltage readings not O.K.:
Test energization according to electrical circuit diagram. If necessary, replace control unit.

yes ↓

Testing completed





34. TEST SOOT BURN-OFF FILTER (1985 model)

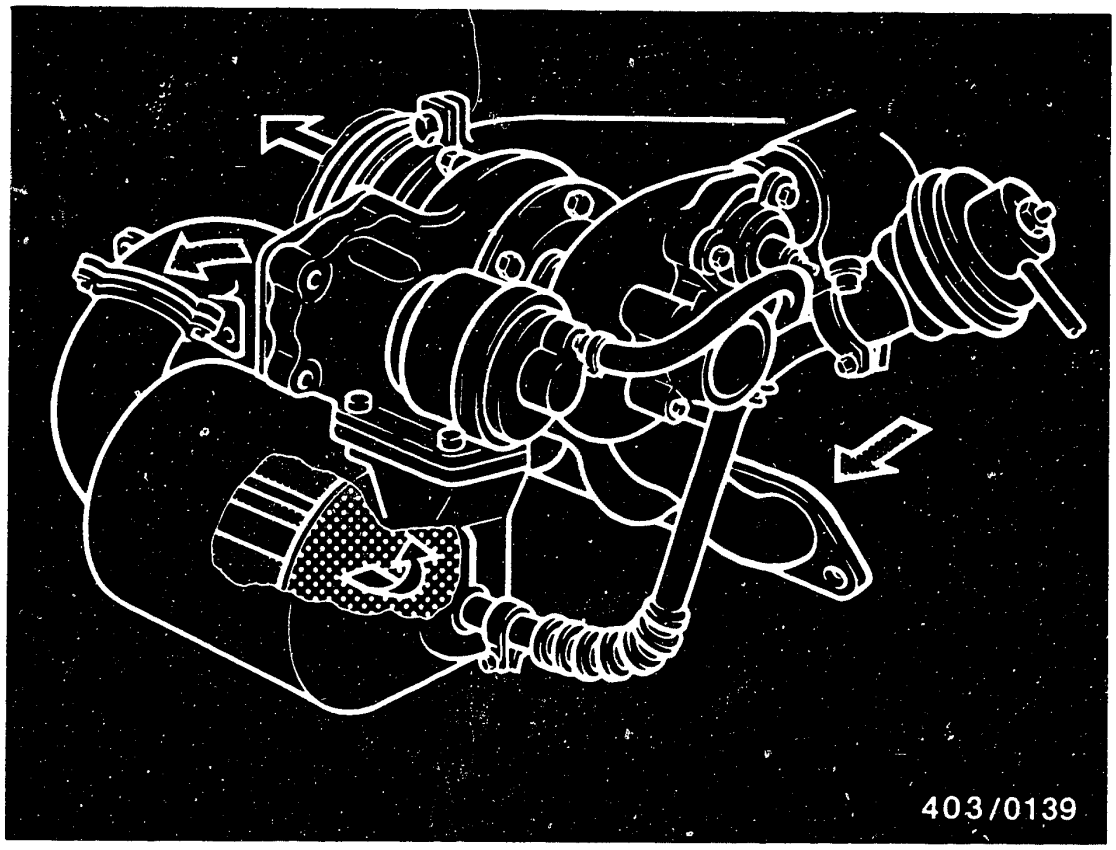
Operating principle of soot burn-off filter

The soot burn-off filter is a self-regenerating filter which is installed before the exhaust-gas turbo-charger.

Caution:

In vehicles with a soot burn-off filter (California model) no additives causing ash-forming residues during combustion may be added to the diesel fuel.

Such residues clog the soot burn-off filter and lead to a heavy loss of power.



Soot-containing exhaust gas

Clean exhaust gas

Regeneration is dependent on:
- exhaust temperature
- oxygen content in exhaust gas
- load condition of engine
- flowrate
- operating time.

Burn-off starts at 360°C. In the case of lengthy exhaust temperatures of greater than 580°C the filter is completely regenerated.
When the soot is burned in the filter, the end product is almost exclusively CO_2.

34.1 Test soot burn-off filter

Connect pressure gauge to test connection M 10x1 on exhaust manifold. Selector lever for automatic transmission to position "P".
Read off exhaust backpressure at 4000 min^{-1}.

Test specification:

0.8...1.3 bar

Test specification obtained?

no

If the measured value is less than 0.8 bar, replace the soot burn-off filter.

If the reading is greater than 1.3 bar, set selector lever to position "2" and drive vehicle on roller-type test stand or on road for approx. 2 minutes, slowly increasing from part load to full load, and test exhaust backpressure.

If, after completion of the test, the exhaust backpressure is likewise greater than 1.3 bar, repeat measurement and, if necessary, replace soot burn-off filter.

yes

Testing of soot burn-off filter completed.

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